

Early-stage use of The Le@rning Federation's learning objects in schools

Results of a field review

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Participants

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Executive summary

The main purposes of this report are:

- to summarise the results of a field review (using survey and case-study data) of early-stage implementation of the online curriculum content developed to date by The Le@rning Federation (TLF); and
- to outline conclusions and recommend ways forward for the program, focusing on the maintenance of the development and implementation processes, and the direction of resources to professional development and evaluation of efficacy.

As reported in an earlier study (Freebody 2005), a review of available research literature indicates that:

- there is now a reasonably well-established body of empirical work on the nature and efficacy of ICT use in school classrooms;
- much of that data points to improved motivational and learning outcomes of ICT use generally;
- there is relatively little reliable guidance or conclusions relating to medium- or long-term effects of ICT use, less on the motivational and learning outcomes of specific kinds of ICT use in classrooms, and even less on the consequences of the use of ICT-based online curriculum content; and
- the research area is characterised by small-scale observation and interview studies. There are very few large- or medium-scale field experiments.

Summary results

1. There continues to be strongly positive responses to use of TLF's learning objects from teachers and students with respect to perceived benefits to both learning outcomes and engagement in learning.
2. This pattern of response applies across all teacher and student demographics; there are no correlations between ratings of the learning objects and any of the respondent variables in the surveys.
3. Multilevel modelling shows considerable variation in the pattern of responses by teachers and students within and between learning objects, and some variation related to curriculum areas.
4. There are major variations in awareness and usage of learning objects in schools, and also in the extent to which learning objects are integrated into learning programs.
5. There is evidence of potentially new learning environments being put to 'old' pedagogical work.

Next steps

The best prospects for enhancing implementation lie in further research and in the professional development of classroom teachers.

The results of this study, together with those of the earlier (2005) study, show that teachers and students who have used the learning objects regard them in generally positive ways, and that their views discriminate among different features of the learning objects and their potentially distinctive benefits.

The next tasks are to document, over a period of time that allows a reasonable establishment phase for the learning objects, how some sustained use of the learning objects influences the nature and extent of changes in pedagogy and in students' learning.

The study

Introduction

The purposes of this report are to provide background material related to the use of online curriculum content and, in that context, to report the outcomes of a field review of early-stage implementation of The Le@rning Federation's (TLF) newly developed learning objects. Presented in the following sections of this report are:

- a brief outline of the history of The Le@rning Federation's 'Learning objects' initiative;
- a summary of the available research literature on the efficacy of use of ICT and online curriculum content generally;
- a summary of the results of a field review, conducted through surveys and case studies, of the implementation of TLF online curriculum content developed to date; and
- conclusions, drawn from the review, concerning the maintenance of this implementation, including the direction of resources to enhance professional development and to ongoing evaluations.

The initiative

In 2001 the Ministerial Council on Education, Employment, Training and Youth Affairs (MCEETYA) established The Le@rning Federation to produce online curriculum materials and make them available to education systems in the States and Territories of Australia and New Zealand. More specifically, TLF was charged with:

1. producing a repository of online materials in the following priority curriculum areas:
 - Innovation, Enterprise and Creativity (Years P–10)
 - Languages other than English (specifically Chinese, Japanese and Indonesian across all school year levels)
 - Literacy for students at risk of not achieving National Literacy Benchmarks (Years P–10)
 - Numeracy and Mathematics (Years P–10)
 - Science (Years P–6 and 9–10)
 - Studies in Australia (Years P–10);
2. developing online materials that:
 - represent cutting-edge best educational theory and practice;
 - engage teachers and students in active learning and in creative and critical thinking;
3. supporting and reinforcing the increasing priority given to innovation, enterprise and knowledge by governments in Australia and New Zealand;
4. supporting teachers in developing enterprising education;
5. engaging students in innovative learning environments;

6. equipping students to live competently and proactively in an environment increasingly characterised by online communication, learning and work; and
7. stimulating the growth of a marketplace for high-quality public and private online curriculum content.

The term 'online curriculum content', as it is used here, refers to interactive learning activities (that may include texts, and/or graphic, audio or animated materials) that improve students' motivation and learning outcomes, and that capitalise in innovative ways on the particular potential of information and communications technologies to enhance young people's learning. In this project, the online curriculum content takes the form of 'learning objects'. These learning objects are:

- one or more files or modules of learning material;
- reusable in multiple settings and for multiple purposes;
- potentially usable in classrooms as components of units of work accompanied by digital and non-digital materials; and
- accessible from digital repositories, as referenced, located and accessed by metadata descriptors.

TLF has undertaken cycles of evaluation designed to monitor and enhance the quality of its educational products and to fulfil its goal of disseminating knowledge about use of information communication technologies (ICT) in educational contexts to inform research and development in this area. This report, representing the second phase of evaluation of early-stage implementation of the learning objects in school, needs to be read in concert with:

- the overall evaluation of the TLF operation by TGF International, the report of which is in preparation and due to be submitted in February 2006; and
- the planned 'best practice' field study to be conducted in early 2006, the report of which is due in late 2006.

The research setting: summary of key studies

The report of the earlier field review of TLF's learning objects program (Freebody, 2005) concluded that the introduction of new digital technologies into classrooms has not, of itself, brought about changes in the nature or extent of learning that some commentators have described as necessary for participation in new economies and forms of citizenship. In that (2005) report it was argued that use of information technologies in education over the last 10 years indicates a need for consideration of the nature of the curricular content and settings in which ICT use occurs within everyday classroom work.

The review presented in Freebody (2005) will not be restated here. However, it was argued in that study there that while research on the features of beneficial learning settings suggests the value of ICT in classrooms, it does not establish the significance or utility of learning objects. For instance, Marzano (1998; and see also Marzano, Gaddy & Dean 2000) found that the meta-analysis of effective instructional techniques and conditions showed the following to be important:

- Explicit teaching of new knowledge accompanied by the students' application of that knowledge in a variety of conditions

- Regular and systematic testing of hypotheses about new knowledge
- Representation of new knowledge in multiple modalities (linguistic, graphic, visual, auditory, etc)
- Use of computer-based, interactive activities to explore, discover and apply new knowledge.

Similarly, the British Educational Communicational and Technology Agency (BECTA) (2005), in a review of research evidence related to the progress of ICT usage in educational settings, pointed to a trend towards better supply of ICT content for schools, although noting that the core curricular subjects appear to be best served in terms of the number of available resources. Of relevance to outcomes of TLF learning objects program, the BECTA report notes a review by Cox and others (2003) indicating that:

... high-quality, interactive learning resources are more likely to be related to higher learning gains for pupils than other resources. The reviews point to substantial evidence of the impact of specific uses, for example, using simulations and modelling in Science and Mathematics. However, impact is dependent on teachers' use and quality of implementation. (p 19)

Other studies related to the learning and motivational consequences of digital learning objects in educational settings include those of Mann et al. (1999) and Passey et al. (2004).

Below are the conclusions drawn from the research reviewed in the course of this study.

- There is now a reasonably well-established body of empirical work on the nature and efficacy of ICT use in school classrooms.
- Much of that research points to improved motivational and learning outcomes of ICT use generally.
- There is relatively little reliable guidance on conclusions relating to medium- or long-term effects of ICT use, less on the motivational and learning outcomes of specific kinds of ICT use in classrooms, and even less on the consequences of the use of ICT-based online curriculum content.
- The research area is characterised by small-scale observation and interview studies. There are very few large- or medium-scale field experiments.

In the report of an earlier study (Freebody 2005), a strong *prima facie* case was established, from direct observation, interview and survey data, for the following:

- The use of TLF online curriculum content is, in general, supported enthusiastically by teachers, parent home-tutors and students.
- The use of TLF online curriculum content motivates students to attend to and engage with tasks.
- The use of TLF online curriculum content enhances students' learning and interest in learning across a range of tasks.

The following challenges, cautions, and speculations were also noted in that report:

- *Time for selection*: Teachers need time to ensure that their selection of learning objects, from an increasingly wide range, is appropriate to their curricular needs.
- *Technical limitations*: Technical difficulties continue to present ongoing frustrations to teachers, and increasingly complex and consequential challenges to education systems.

- *Varying task domains*: Online curriculum content may operate more effectively in some task domains and for some learning purposes than in others. These domains and purposes may not be equally distributed across curriculum subject areas.
- *Access*: The nature and extent of access to online curriculum content affects the nature and efficacy of usage.

In this second study, the findings of the earlier study were tested, using improved instrumentation and sampling, by revisiting the perceptions, practices and recommendations of school colleagues about one year later, in order to develop a better sense of the range of classroom practice related to use of learning objects.

Methods

As with the earlier study, this evaluation of the early-stage classroom use of TLF's learning objects draws on two data sources – surveys and case studies. The surveys were web-administered to teachers and students (with paper-copy back-up); case study sites were visited, where principals, teachers and students were interviewed and lessons observed.

Surveys

The survey was administered electronically, though use of SurveyMonkey software. TLF associates in each State and Territory provided teachers and students in participating schools with the survey URLs and encouraged them to respond. Separate surveys were designed for students (see Appendix 1) and teachers (see Appendix 2). After pilot administration in mid 200, the final version was sent for online response in August 2005. Responses are included at various places in the analysis to expand on the responses to the main survey questions.

The main questions concerned respondents' overall judgements about the motivational and instructional efficacy of the online curriculum content used on the school site, along with a set of questions relating to the demographic background of the respondent and the school's students. Further, questions related specifically to the use of TLF online curriculum content. Teachers were asked to rate the helpfulness of TLF online curriculum content in supporting teaching and learning, and whether or not TLF online curriculum content improved students':

- motivation
- persistence
- depth of learning
- higher-order concepts
- collaboration with peers
- independence in learning.

Students were asked whether or not TLF online curriculum content was:

- interesting and fun
- easy to work with
- helpful in thinking about new ideas
- best when student worked with a partner

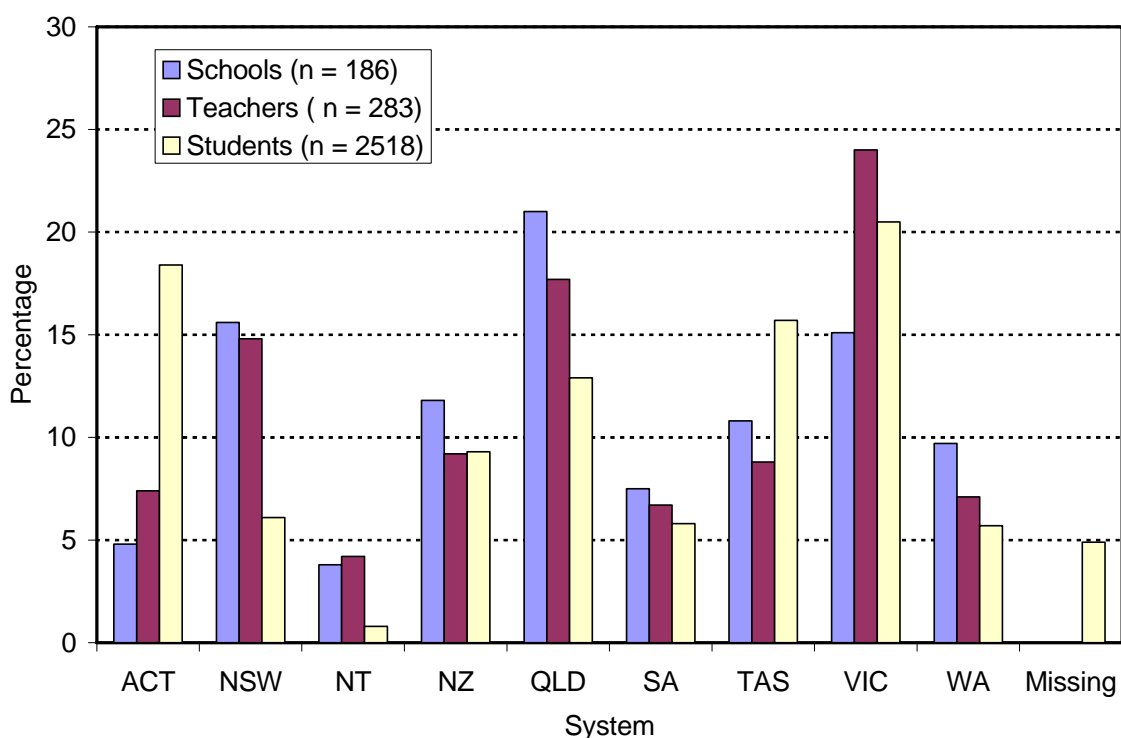
- such that the student needed a lot of help from his or her teacher.

Students were also asked about the helpfulness of various characteristics of the learning objects, including:

- sound
- animation
- interactivity
- self-paced nature
- repetition of activities until successful
- reception of feedback
- clear instructions for improvement.

The numbers of respondents and the breakdown of responses by State and Territory are shown in Figure 1.

Figure 1: Spread of responses to the web-delivered survey by State and Territory



Of the student respondents, 47 per cent were female and 53 per cent male; and 51 per cent attended primary schools and 49 per cent secondary schools. Among teachers, 70 per cent were female and 30 per cent male; and 51 per cent worked in primary schools and 49 per cent in secondary schools.

Students' responses to the learning object they had most recently used, grouped according to the curriculum area of that learning object, are shown in Table 1. It is important to note that data relating to the learning objects drawn from Innovation, Enterprise and Creativity should be treated with extreme caution due to their very low rate of reported use among this sample of students. For the same reason but to a lesser extent, data related to learning objects for Languages Other Than English should also be cautiously interpreted.

Table 1: Proportion of students' responses by curriculum area of learning object

Curriculum area	Mathematics / Numeracy	Science	Studies in Australia	Literacy (for at-risk)	LOTE	Innovation, Enterprise, Creativity
% of students' responses	32	26	17	16	7	2

Case studies

Case studies were conducted in 17 schools. The schools' settings ranged from urban (11) to rural (3) and remote (3). Seven were primary schools, seven were secondary, two had K–12 enrolments, and one had K–8 enrolments.

Some special features of these schools included the following:

- Five schools had high proportions of Indigenous students.
- Three schools had high proportions of students who had special needs or who were considered 'at high risk' for a variety of reasons.
- Two were girls' schools.
- One was a distance education centre.

Findings

There are five main findings from the surveys and case studies:

1. There continues to be strongly positive responses to use of TLF's learning objects from teachers and students with respect to perceived benefits to both learning outcomes and engagement in learning.
2. This pattern of response applies across all teacher and student demographics; there are no correlations between ratings of the learning objects and any of the respondent variables in the surveys.
3. Multilevel modelling shows considerable variation in the pattern of responses by teachers and students within and between learning objects, and some variation related to curriculum areas.
4. There are major variations in awareness and usage of learning objects in schools, and also in the extent to which learning objects are integrated into learning programs.
5. There is evidence of potentially new learning environments being put to 'old' pedagogical work.

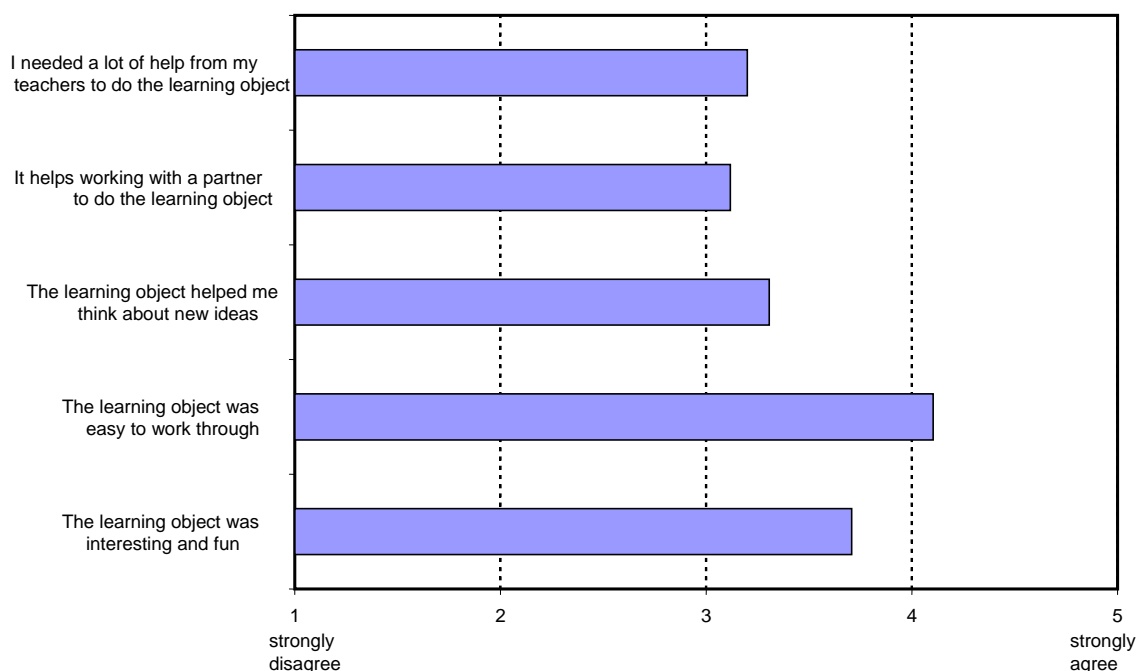
Each of these is discussed briefly below in terms of the data drawn from the surveys and case studies undertaken for this study.

The survey data

Students' responses to the survey items

The students' responses to key survey items are summarised in Figure 2.

Figure 2: Overall student evaluations of the learning objects

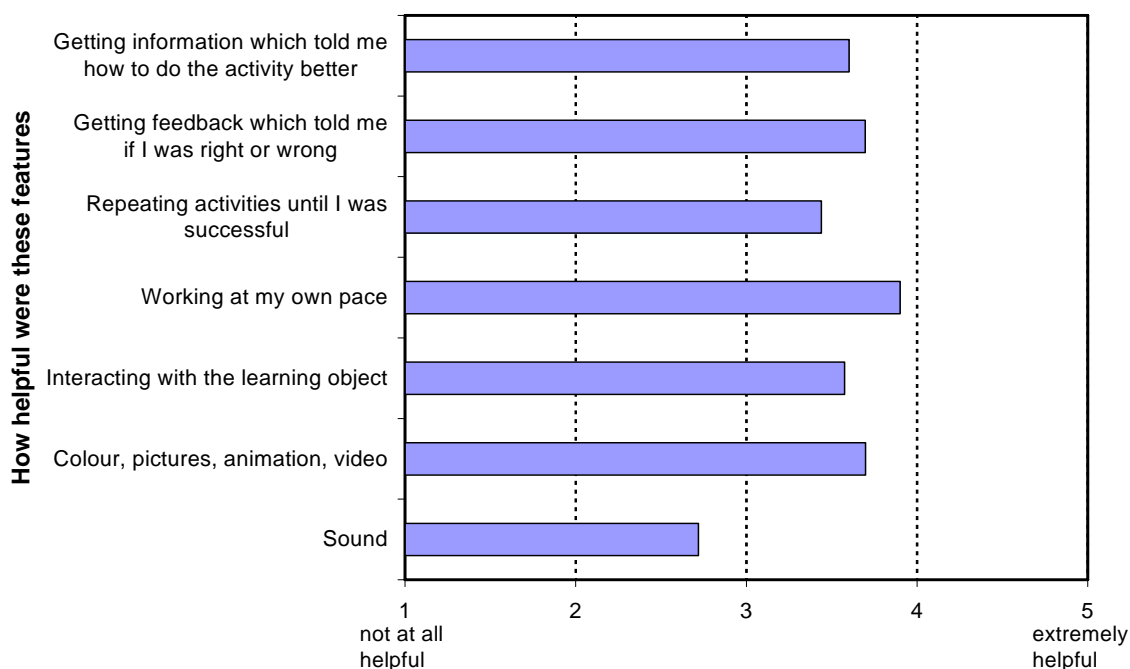


These mean ratings indicate that the students made clear distinctions between the different variables under consideration. While small differences are generally statistically reliable with sample sizes of this magnitude, the top three items illustrated in Figure 2 are only marginally on the positive side of the neutral mid-point on the rating scale. That is, students reported close-to-neutral views of the helpfulness of the learning objects in terms of ‘thinking about new ideas’ and, as a group, had no decisive views on the need for help from teachers or partners/peers. Students were more decisive in their support for the learning objects as ‘easy to work through’ and ‘interesting and fun’ to complete, compared to their potential for stimulating ‘thinking about new ideas’. This may indicate that learning objects were seen to be a little too unchallenging overall, and/or it could mean that the capacity of digital objects in general to motivate (including the motivational value of successful completion) is seen to be a significant asset, while their ability to stimulate reflection and novelty of thought is not taken to be as significant an attribute.

In summary, the interest, fun and ‘do-ability’ of the learning objects was strongly endorsed by this sample of students.

Figure 3 displays the students’ judgements of the helpfulness of certain features of the learning objects, in particular, aspects that helped them learn from the learning objects.

Figure 3: Students' judgements of the features helping them learn from learning objects



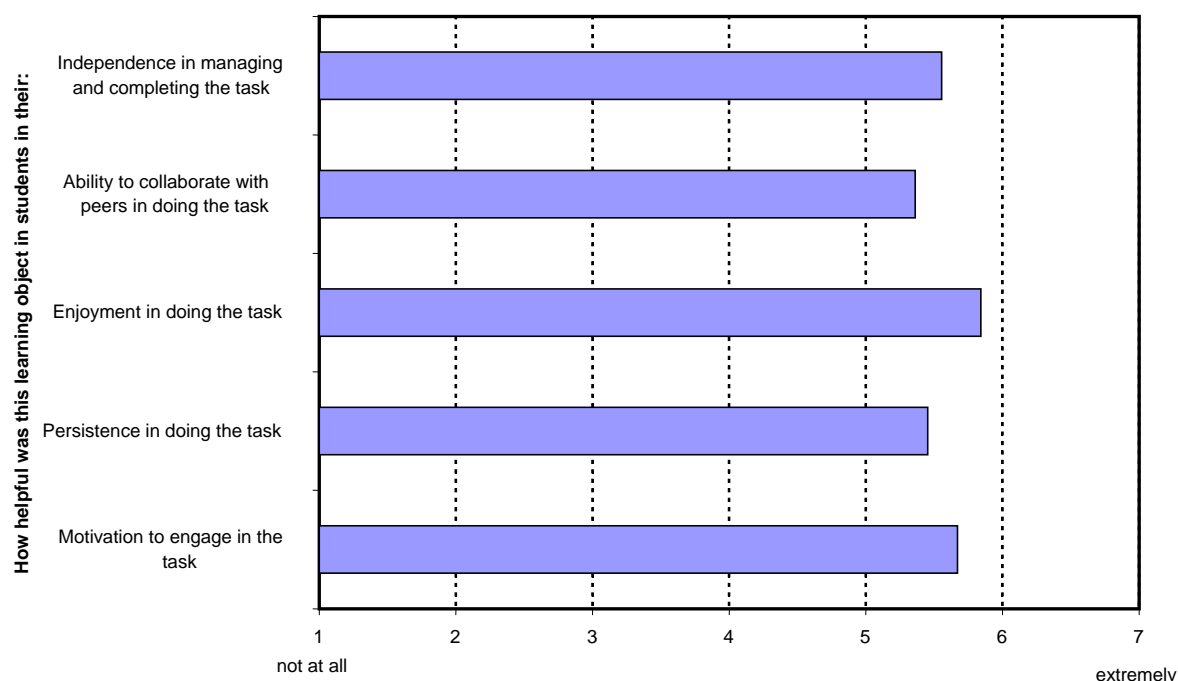
Of note here is the significantly positive ratings of all the features listed, with the exception of the 'sound' characteristics of the learning object. While all positive rankings are reliably above the neutral point, these students gave highest ranking to the opportunity to work at their own pace in the completion of the learning object activity. This is an ongoing attribution to the learning objects that is compatible with results of the earlier study (Freebody 2005) and from the case-study findings discussed below. Also from the case studies and from classroom trials comes the observation that students may use the learning objects in settings in which the sound needs to be muted (or switched off entirely) in recognition of students working nearby on other materials. This may account for the low ratings of sound as helpful. An alternative explanation may be that the sound components are regarded as engaging or entertaining rather than 'helpful' in the sense of 'helpful to learning'.

What is clear, in the light of the overall positive ratings of the learning objects for motivation and learning, is that all the features apart from the sound characteristics of the learning objects are regarded as helpful, and (critically) that students recognise the advantages of the use of learning objects over ordinary whole-class or small-group work in the classroom in terms of improved learning, feedback, choice of pace, sequence and interactive content.

Teachers' responses to the survey items

Figure 4 presents a summary of the teachers' views of the potential of learning objects for motivating and engaging their students.

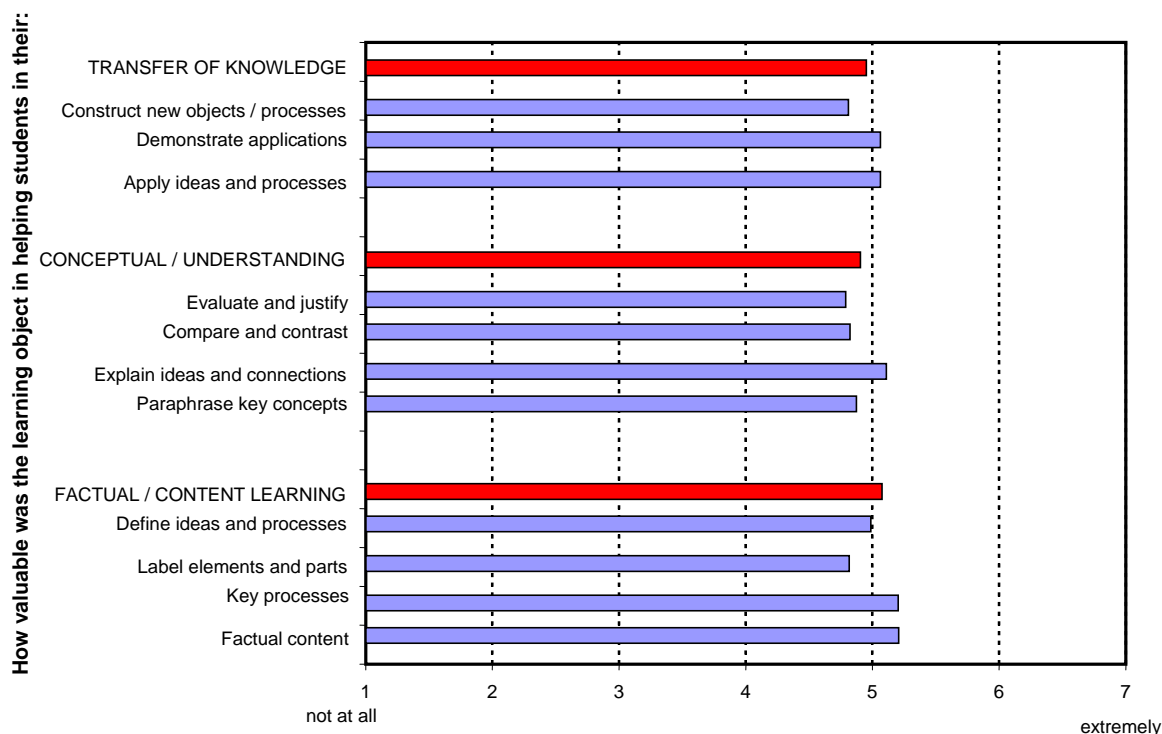
Figure 4: Teachers' perceptions of motivational effects of learning objects



The teachers were presented with 7-point scales for each of these five items, so as to maximise the differentiation of judgements available to them and also the variation available for analysis. All of the means presented in Figure 4 are substantially, and statistically significantly, above the neutral mid-point of 4. Differences between these means are not such that any highly differentiated response patterns to the various items are evident; that is, teachers strongly endorsed the helpfulness of the learning objects on all of the counts offered to them. This finding is compatible with both the results of the earlier study (Freebody 2005) and the descriptions presented in the case studies below.

For purposes of ongoing development and to contribute to the growing field of research in this area, it is of interest to know what particular aspects of learning the teachers believed the learning objects enhanced. To that end a series of questions were asked about the value of the learning objects in general in helping students learn and use different kinds of knowledge. A summary of teachers' ratings of these features is presented in Figure 5. Note that on the vertical axis the original variables are named in lower case. In addition, factor analysis revealed three highly reliable factors (Cronbach's alphas: transfer 0.91; conceptual 0.89; factual 0.84) that directly reflected the conceptually generated variable sets. Upper case labels on the vertical axis refer to these three factors.

Figure 5: Teachers' perceptions of learning outcomes from learning objects



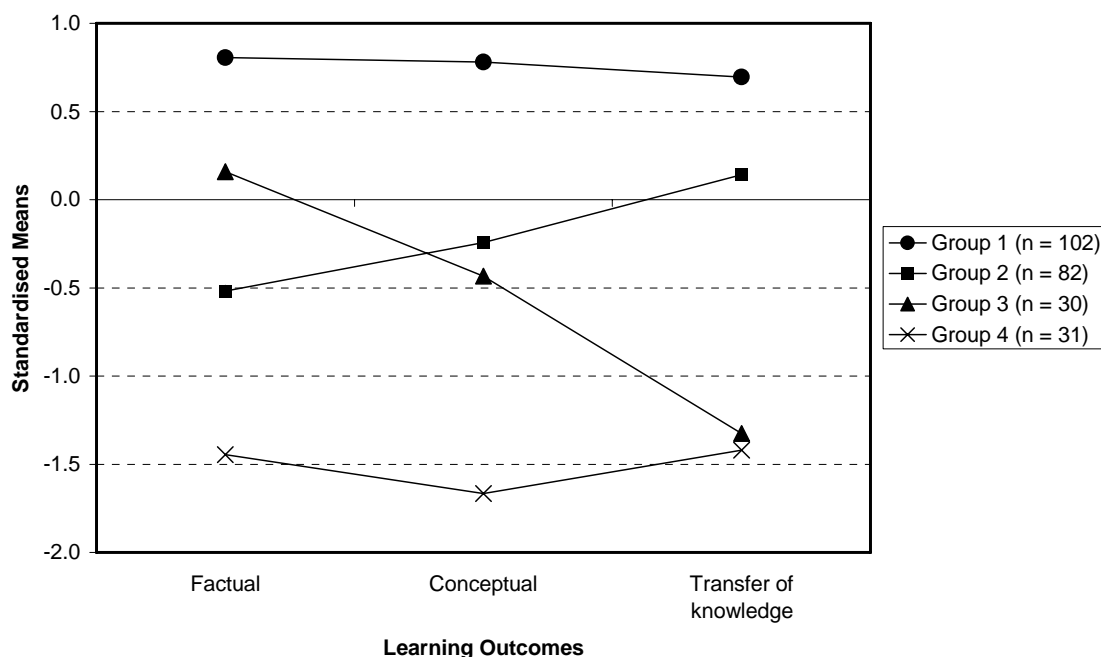
Again, the ratings are substantially above the neutral mid-point for all variables, and the differences in mean ratings are not remarkable. The three composite scores have very close mean values, indicating strong average endorsement of all forms of learning presented in the survey. Two points are worth noting in this regard:

- The items were developed in the light of comments provided in the earlier study (Freebody 2005) and thus were taken to reflect statements about the learning objects offered by the teachers sampled in that study.
- There was considerable variation of response, sufficient to warrant exploration of discernible patterns of response among the sample of teachers; and further analysis of the relationships among those patterns, the particular settings in which these teachers worked and the particular learning objects to which they were referring.

Cluster analysis of results of the surveys of both students and teachers

In cluster analysis, respondents are grouped into 'families' whose overall response profiles are most alike, gradually noting the diminishing returns of variance accounted for as the number of clusters increases. To explore possible patterns or profiles of response among the teachers, a cluster analysis was conducted on the three composite variables indicated in Figure 5: a focus on factual content, a focus on conceptual understanding, and a focus on the transfer or application of knowledge. The outcome of the cluster analysis is presented in Figure 6.

Figure 6: Results of cluster analysis of teachers according to their assessments of learning outcomes of learning objects



In general, the four-cluster solution provided a good fit, accounting for about 66 per cent of the overall variance on the original three variables. It can be noted that two groups (Group 1 and Group 4), comprising 42 per cent and 13 per cent of the entire sample respectively, responded significantly higher and lower than the overall mean on all three composite measures. The other 45 per cent of the sample broke into two groups that showed clear differentiation on the three measures, one group (Group 3) indicating that they believed the learning objects were beneficial mostly for learning pertaining to factual content and the other (Group 2) emphasising comparative benefits for the transfer and application of knowledge. Ratings on conceptual understandings were the same for these cross-over groups. What this means is that individual perceptions, differences among the contents and purposes of the various learning objects, or both, are leading almost half of the sample of teachers to discriminate among the potential beneficial outcomes of the learning objects.

No associations were found between responses, cluster membership, and the student or teacher demographics we assessed; that is, differing degrees of like or dislike, and nominations of key features were all distributed ‘randomly’ across the teacher and student samples.

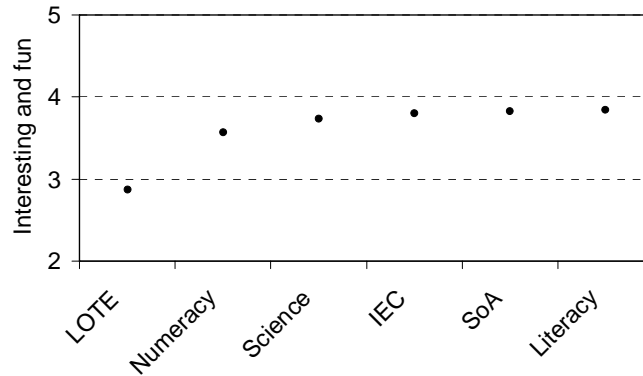
There were, however, strong statistical associations between students’ ratings of the learning objects and the curriculum areas in which the learning objects were located and also the individual learning objects themselves, independently of their curriculum area designation. With respect to the overall students’ ratings, for instance:

- LOTE learning objects tended to rate lower on overall approval than the other curriculum areas, and Literacy learning objects a little higher than the other curriculum areas.
- The negative effect for LOTE learning objects was general, but is statistically reliable only for ‘interesting and fun’ and ‘helps me think about new ideas’. These contrasts are shown in Figures 7a and 7b. (It is important to note in considering

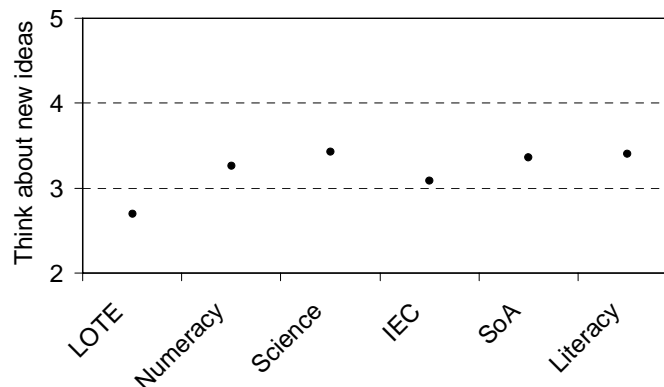
these figures that the curriculum area ‘Innovation, enterprise and creativity’ was referred to in so few responses that the means are not reliable indicators.)

Figures 7a and 7b: Mean scores for learning objects within curriculum area on students’ judgements of how ‘interesting and fun’ they are (7a) and how much they ‘help me think about new ideas’ (7b)

7a



7b



Curriculum area effects were also associated with significant statistical relations to the set of variables under the heading ‘how helpful were the various features of the learning objects?’ These effects are statistically reliable. While the magnitudes are not great, LOTE, in particular, tended to rate lower on ‘helpful features’ than did the other curriculum areas, and Literacy higher. The examples shown below in Figures 8a and 8b show the relative distributions around the grand means for the use of sound and the provision of feedback, but the general shapes are typical of the distributions on all variables, which were:

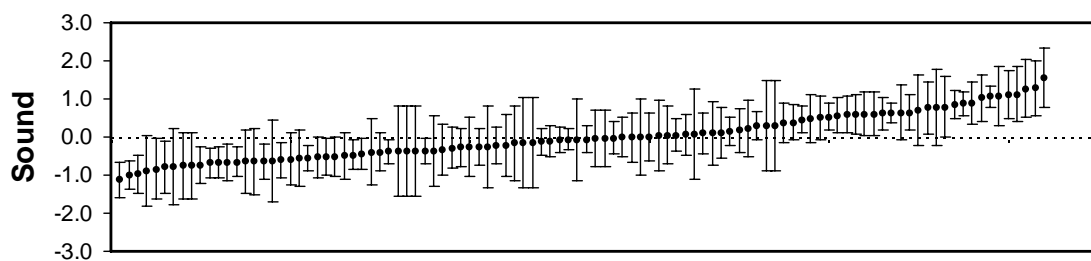
- use of sound
- use of colour, pictures, animation and videos
- interactivity of the learning object
- ability to work at my own pace
- ability to repeat activities until I was successful

- getting feedback which told me I was right or wrong
- getting information from the leaning object on how to do the activity better.

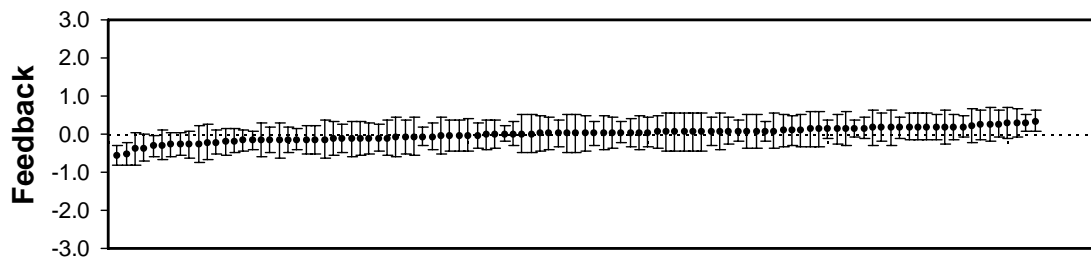
Further, some learning objects are rated more highly than others, but those rated highly for a particular feature are not the same set as those rated highly for a different feature. In addition, there is more variability associated with individual learning objects for on-screen features (the first three of the bulleted items above) than for off-screen features afforded by the learning object (the final four of the bulleted items above). Figures 8a and 8b demonstrate the contrast in its most extreme form, that is, the contrast for the variables ‘sound’ and ‘feedback’.

Figures 8a and 8b: Distribution of means and standard deviations (dot-and-whiskers style) around the grand mean for the 90 learning objects referred to in the student survey data on their estimates of the value of ‘sound’ (8a) and the provision of ‘feedback’ (8b)

8a



8b



In summary, the findings of the surveys directly reflect the findings of the earlier study (Freebody 2005), particularly with respect to the strongly positive responses to the learning objects from teachers and students. In these responses, which apply to perceived benefits to both learning outcomes and engagement in learning, both teachers and students indicated some discernment and discrimination in their ratings of various aspects of the learning objects and the potential outcomes of using them.

Unlike the findings of the earlier study, the rating patterns in the sample surveyed this time applied across all teacher and student demographics, and there were no correlations between ratings of the learning objects and any of the respondent variables. However, multilevel modelling revealed that responses varied according to the learning object that respondents had most recently used, and that some variation was directly related to lowered ratings for LOTE learning objects.

The case studies

Brief case studies are presented in Appendix 3. As a general observation of the 17 schools:

- In one school, the use of the learning objects was embedded into general, conventional teaching practices.
- In five schools, substantial use of learning objects was restricted to a small proportion of teaching staff;
- In six schools, some teachers used the learning objects from time to time.
- In five schools, use of the learning objects was only in the very earliest stages of awareness and implementation.

Some general issues arising from the case studies are discussed below in terms of the key items of both surveys, so as to supplement the survey data with some site-specific detail and sense of variation within and between school sites.

When asked for their views on the ‘key features’ of the learning objects, there was a high level of consistency among teachers’ comments, as illustrated below.

I love the way [the learning objects] engage kids and help them in the production of their work. They are so powerful in that regard. They are a great tool in our repertoire of engaging kids ... Students are working at their own pace and ... being responsible for their own learning. We can use them across the board, and find them especially helpful with our integration students. (Teacher, Brighton Primary School)

This comment draws attention to the notion that students’ engagement in learning, as an outcome of using the learning objects, has two corollaries: students are able to work at their own pace, and they take responsibility for their learning. In the above comment, the teacher explicitly cognitive and dispositional/attitudinal consequences. The breadth of applicability of the learning objects is also noted, as are the particular benefits accruing to students with special needs, indicating that the high levels of variation in the available learning objects is regarded, in this case at least, as offering distinct benefits.

The capacity of the learning objects to cater for significant differences in students’ entry-level knowledge of a topic was noted by some teachers.

One of the major issues for the students I work with is finding the right starting point to enable them to learn effectively. In their normal classroom work the entry level can be just too high. Through using the [learning] objects I find that we can progress at a much faster rate through the syllabus and the sorts of content we want them to master. (Teacher, Good News Lutheran School)

Of note in the above comment is the direct relationship of the learning objects to the syllabus in use in the classroom and the special benefit of the learning objects in permitting individual students to find the entry level that suits them, along with subsequent acceleration of their progress through syllabus materials. As the learning objects are developed as ‘stand-alone’ learning materials with no intended tight fit with any particular syllabus, curriculum materials or pedagogical configuration, the above comment about syllabus progression is of special interest and importance.

For many students it is clear that standard classroom practice presents difficulties. Whole-class activity provides distinctive opportunities for hearing, valuing, and sharing ideas, but with content and sequence directed by and filtered through the teacher’s goals, it is assumed that students have high levels of shared knowledge, attention, and processing. The use of the learning objects was seen by many of the teachers in the case studies as a way of offering other learning experiences for which the standard classroom is either not an optimal setting for learning or not the only setting in which learning can occur. Teachers often noted the dramatic effects of using learning objects for students

who have experienced difficulties in standard classroom conditions. For example, the following comment was contributed by a teacher who works in a centre for students not attending conventional schooling due to behaviour issues:

The independence kids can achieve is phenomenal. Variety, motivation, flexibility, ease of use, the interactivity is very important ... They re-read – we do notice this – go back and recover. Being able to repeat is very important. It is an additional incentive, which otherwise would not be there and which our kids need, to get things right. (Teacher, Eclipse Centre, Canberra College)

This comment affords a particular insight into the often unremarked problem faced by many students faced with whole-class activity. A feature of whole-class activity and interaction is that the teacher takes a sample response from a student (or from two or three students) to ‘stand for’ the state of knowledge and understanding of the whole group. The decision to move on to the next point in the work, made on the basis of one student’s demonstrated competence with the prerequisite knowledge and understanding, may not be appropriate for a significant proportion of students in the room. This process is often referred to as ‘cohorting’ (see Edwards & Westage 1994; Freebody 2003). In the simplest form of cohorting, the teacher asks a question, a student gives a possible answer, the teacher confirms the acceptability of the answer and moves on to the question that logically follows it. The vast bulk of studies of classroom interaction in countries comparable to Australia confirm that cohorting is a practice that effectively defines whole-class activity and whole-class interaction.

For students whose knowledge or understanding does not routinely allow participation in standard whole-class or even small-group activity, the cumulative effect of regular, long-term non-participation or engagement in the accumulation of relevant knowledge can be dramatic. Their engagement and willingness to revisit and repeat activities in the light of feedback, when using the learning objects, is significant (see, for example, the case of the Eclipse Centre, in Appendix 3).

One long-term, dedicated and effective user and advocate of the learning objects in classrooms encapsulated her understanding of the particular benefits offered by the learning objects:

They encourage a high level of engagement from students because of their interactivity; the open-endedness of many of the [learning] objects stimulates further independent learning; and the screen and interface are generally very clear and accessible. (Teacher, Atherton Primary School)

This combination of format, technology, learner engagement and disposition and cognitive outcomes represents a succinct summary of the various positive perceptions of learning objects by most of the participants in the case studies.

New technologies, old pedagogies

A variety of pedagogical applications of the learning objects was observed in the schools of the case studies. Because of the wide variety of settings in which the learning objects might be used, and because future settings may have attributes that go beyond what can yet be predicted, The Le@rning Federation does not offer pedagogical advice or recommendations to accompany any learning object. It is possible that some settings will evolve as use of products such as TLF’s learning objects become more prevalent. However, at this point, some teachers and school personnel were incorporating learning objects into units of work or shorter-term activities in ways that did not seem to

capitalise on the strengths that other colleagues were nominating as the special benefits of learning objects:

Pedagogy is 'influenced but not determined' by LO use. ... We saw the LOs [learning objects] being used in ways ranging from the tightest lock-step process imaginable to unsupported open choice ... Some of the considerations that guided the thinking of some schools' staff were that LOs [learning objects] should be used for a particular educational purpose only and not as a time-filler ('if they were openly accessible they might lose some of their appeal and interest'); only the teacher should be making judgements about their use to optimise learning. We saw cases where all accessible [learning] objects were made available for staff as part of the school's digital resource library and were indexed and delivered in a structured, predetermined way. (David McRae, in summary notes of the case studies)

This issue of whether the learning objects are seen as 'textbooks' or 'library books' is captured in the case studies described in Appendix 3. While TLF may be agnostic on the matter of pedagogy, the strongest reasons given in support of the learning objects in the findings of this and the earlier study – students' working at their own pace, taking responsibility for their own learning, being presented with choice and flexibility – contrast with what is offered students in standard classroom settings. To put it bluntly, 'bringing the learning objects to heel', such that their use is made to fit with the imperatives and routines of the standard classroom setting, would seem to run counter to what students and teachers in this and the earlier study consistently put forward as the special benefits of learning objects, especially when the learning objects are offered to students not well served by standard classroom provision.

Conclusions and ways forward

The results of this study, together with those of the earlier (2005) study, show that teachers and students who have used the learning objects regard them in generally positive ways, and that their views discriminate among different features of the learning objects and their potentially distinctive benefits.

The next tasks are to document, over a period of time that allows a reasonable establishment phase for the learning objects, how some sustained use of the learning objects influences the nature and extent of changes in pedagogy and in students' learning.

To preserve and enhance the substantial investment in the development phases of the initiative now requires patient but rigorous research in the implementation phase. The outcomes of using learning objects rely not just on the intrinsic properties of the learning objects but on the teaching and learning processes adopted in classrooms.

As school systems and colleagues in schools take the investment to the next phase in terms of producing high-quality teaching and learning environments, the research imperative is to support, expand and document classroom 'best processes' in close collaboration with school colleagues.

The need for studies of implementations and outcomes is also in line with the best advice from researchers and professional educators currently grappling with questions of ICT use in education. Nichols (2001), for example, outlines six imperatives for the development of education in the 21st century:

1. Increase teaching and learning capacity, offering more and more different students learning opportunities at the same time.

2. Improve the effectiveness of learning by focusing on deep and directly applicable learning.
3. Increase the ease of access to powerful learning materials and experiences.
4. Provide more choice and diversity of learning materials and experiences.
5. Emphasise resource-based educational provision, offering students more control over what, when, how and where they study.
6. Increase the interactivity of materials, emphasising engagement and genuinely successful experiences.

The comments and observed activities of colleagues in schools and students who participated in the surveys and case studies summarised here and in the earlier (2005) study consistently characterise the use of learning objects as relevant to all these imperatives. The task now is to encourage and document the broadest possible range of good practices with learning objects, while at the same time actively remaining alert to the retrograde uses to which any promising initiative can be put. The Le@rning Federation's learning objects initiative is well placed to offer special answers to some of the thornier questions facing educators interested in ICT (and perhaps, more particularly, the students of those who are not). To pursue those answers may mean first acknowledging the tensions associated with the task and the high stakes of task failure in the outcomes for communities, educational systems, schools, individual teachers and students.

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Appendix 1: Survey of students

Using TLF online content – survey of students, 2005

About you

1. What is the name of your school?

2. What grade or year level are you in?

K/P/R	<input type="checkbox"/>	7	<input type="checkbox"/>
1	<input type="checkbox"/>	8	<input type="checkbox"/>
2	<input type="checkbox"/>	9	<input type="checkbox"/>
3	<input type="checkbox"/>	10	<input type="checkbox"/>
4	<input type="checkbox"/>	11	<input type="checkbox"/>
5	<input type="checkbox"/>	12	<input type="checkbox"/>

3. Are you

Male	<input type="checkbox"/>
Female	<input type="checkbox"/>

4. How often do you use computers outside of school?

Everyday	<input type="checkbox"/>
Four to six times a week	<input type="checkbox"/>
2-3 times a week	<input type="checkbox"/>
2-3 times a month	<input type="checkbox"/>
Rarely or never	<input type="checkbox"/>

5. How often do you use the internet outside of school?

Everyday	<input type="checkbox"/>
Four to six times a week	<input type="checkbox"/>
2-3 times a week	<input type="checkbox"/>
2-3 times a month	<input type="checkbox"/>
Rarely or never	<input type="checkbox"/>





6. What do you enjoy most?

Maths	<input type="checkbox"/>
English	<input type="checkbox"/>
Science	<input type="checkbox"/>
SOSE/HSIE	<input type="checkbox"/>
Art	<input type="checkbox"/>
Technology	<input type="checkbox"/>
Health PD/PE	<input type="checkbox"/>
Other (please specify)	

About the learning object you are using

7. What is the name of the learning object you have just used?

8. How much do you agree with these statements?

	strongly disagree	disagree	not sure	agree	strongly agree
					
The learning object was interesting and fun	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
The learning object was easy to work through	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
The learning object helped me think about new ideas	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
It helps working with a partner to do the learning object	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I needed a lot of help from my teacher to do the learning object	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

9. How helpful were these features / aspects of the learning object for your learning?

	not at all helpful	a bit	somewhat helpful	pretty helpful	extremely helpful
The sound	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
The colour, pictures, animations and videos	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Interacting with the learning object	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Working at my own pace	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Repeating activities until I was successful	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Getting feedback which told me if I was right or wrong	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Getting information which told me how to do the activity better	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

10. How would you rate the learning object you have just used?

Not good for learning -----great for learning

1	2	3	4	5	6	7
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

11. How would you rate the learning object you have just finished using?

Does not make me want to learn -----makes me want to learn

1	2	3	4	5	6	7
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

12. Overall, do you think using this learning object is a good idea? Why, or why not?

Appendix 2: Survey of teachers

Using TLF online content – survey of teachers, 2005

About you

1. What is the name of your school?

2. What teaching qualifications do you have?

2 year Diploma

3 year Diploma

4 year Bachelor of Teaching

Undergraduate Degree plus Graduate Diploma of Teaching

3. In your undergraduate training did you specialise in any of the following areas? (select all that apply)

Language / Literacy / English

Numeracy / Mathematics

Science / Technology

Studies of Society and the Environment / HSIE

Languages other than English

Health and Physical Education

The Arts

Other (please specify)

4. Do you have any additional qualifications at the graduate certificate / graduate diploma level or at the master's level that specifically relate to Information Communication Technologies in education?

Yes

No

5. Do you have additional higher qualifications

Master of Education

Other masters' degree

Specialised graduate certificate or diploma (e.g., in educational leadership, curriculum, or other areas of study apart from ICT in education)

6. What is your gender?

Male

Female

7. How long have you been a teacher?

1st year of teaching

2 - 5 years

6 - 10 years

11 - 15 years

16 - 20 years

more than 20 years

8. How long have you worked as a teacher at this school?

- 1st year of teaching
- 2 - 5 years
- 6 - 10 years
- 11 - 15 years
- 16 - 20 years
- more than 20 years

ICT knowledge and Professional Development

1a. How familiar would you say you are with the use of Information Communication Technologies in the classroom as they relate to standard ICT activities such as Word and or PowerPoint?

Not at all familiar -----Very familiar

- | | | | | | | |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

1b. Have you engaged in professional development activities to enhance your familiarity with use of ICT of this kind in the classroom?

No PD -----Extensive PD

- | | | | | | | |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

2a. More specifically, how familiar are you with the use of digital online curriculum resources, e.g., digital encyclopaedia, websites, in general in the classroom?

Not at all familiar -----Very familiar

- | | | | | | | |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

2b. Have you engaged in professional development activities to enhance your familiarity with the general use of digital content in the classroom?

No PD -----Extensive PD

- | | | | | | | |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

3a. More specifically again, how familiar are you with the use of learning objects, such as those produced by TLF, in the classroom?

Not at all familiar -----Very familiar

- | | | | | | | |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

3b. Have you engaged in professional development activities to enhance your familiarity with the use of digital learning objects in the classroom?

No PD -----Extensive PD

- | | | | | | | |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

About your school

1. Country/state/territory of school

- ACT
- NSW
- NT
- NZ
- QLD
- SA
- TAS
- VIC
- WA

2. School sector

- Govt
- Catholic
- Independent

3. The school is

- Co-educational
- Single sex – female
- Single sex – male

4. What is the total enrolment of your school

- 1-25
- 16-100
- 101-200
- 201-300
- 301-400
- 401-500
- 501-600
- 601-700
- 701-1000
- More than 1000

5. Does your school include proportions of students who are:

Language backgrounds other than English

- | None | 1-10% | 11-20% | 21-30% | 31-40% | 41-50% | 51-60% | 61-70% | 71-80% | 81-90% | 91-100% |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

Indigenous

- | None | 1-10% | 11-20% | 21-30% | 31-40% | 41-50% | 51-60% | 61-70% | 71-80% | 81-90% | 91-100% |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

Low socio-economic

- | None | 1-10% | 11-20% | 21-30% | 31-40% | 41-50% | 51-60% | 61-70% | 71-80% | 81-90% | 91-100% |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

About the learning object you are using

1. What year level/s are you teaching with this learning object?

K/P/R	<input type="checkbox"/>	7	<input type="checkbox"/>
1	<input type="checkbox"/>	8	<input type="checkbox"/>
2	<input type="checkbox"/>	9	<input type="checkbox"/>
3	<input type="checkbox"/>	10	<input type="checkbox"/>
4	<input type="checkbox"/>	11	<input type="checkbox"/>
5	<input type="checkbox"/>	12	<input type="checkbox"/>

2. What is the name of the learning object you used with your class?

3. In what curriculum area did you use this learning object?

Eng/Lit	<input type="checkbox"/>
LOTE – Chinese/Japanese/Indonesian	<input type="checkbox"/>
Maths/numeracy	<input type="checkbox"/>
Science	<input type="checkbox"/>
SOSE/HSIE	<input type="checkbox"/>
The arts	<input type="checkbox"/>
Integrated unit	<input type="checkbox"/>
Other (please specify)	

More about the learning object

How valuable was the learning object your class used in helping students in their:

1. Factual / content learning

	Not at all					Extremely		
	1	2	3	4	5	6	7	NA
To know the key factual content of the topic?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
To know the key processes involved in the topic?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
To label elements and parts?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
To state and define ideas and processes?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

2. Conceptual / understanding

	Not at all					Extremely		
	1	2	3	4	5	6	7	NA
To summarise and paraphrase key concepts?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
To explain ideas and connections among key concepts?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
To compare and contrast among key concepts?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
To evaluate and justify key concepts?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

3. Transfer of knowledge

	Not at all					Extremely		
	1	2	3	4	5	6	7	NA
To apply key ideas and processes to new settings or problems?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
To demonstrate applications to new settings or problems?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
To design and or construct new objects or processes	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

through the application of key concepts?

General

Please consider the motivational outcomes of the learning object you are using.
How valuable was this learning object in helping students in their:

1. Motivation to engage in the task

Not at all -----Extremely
1 2 3 4 5 6 7

2. Persistence in doing the task?

Not at all -----Extremely
1 2 3 4 5 6 7

3. Enjoyment of doing the task?

Not at all -----Extremely
1 2 3 4 5 6 7

4. Ability to collaborate with peers in doing the task?

Not at all -----Extremely
1 2 3 4 5 6 7

5. Independence in managing and completing the task?

Not at all -----Extremely
1 2 3 4 5 6 7

6a. Have you used other TLF learning objects?

Yes
No

6b. If yes, what were they?

6c. How would you rate the learning object you are using now compared to those other you have used?

Much worse for learning -----Much better for learning
1 2 3 4 5 6 7

6d. How would you rate the learning object you are using now compared to those other you have used?

Much worse for learning -----Much better for learning
1 2 3 4 5 6 7

7. Overall, do you think using this learning object is a good idea? Why, or why not?

Thank you for completing this survey for The Le@rning Federation.

The Le@rning Federation is an initiative delivered on behalf of the Australian Education System Officials Committee (AESOC) by a joint venture of Curriculum Corporation and **education.au limited**.

Appendix 3: Reports of case studies

Atherton State Primary School

Context

Atherton is a regional centre with a population of about 6000, located 100 kilometres west of Cairns but about 800 metres above sea level. The surrounding area is noted for primary production of tropical and other produce – coffee, corn and other grains, milk, peanuts and mangoes. Part of the Cairns hinterland, it is located on a route taken by an increasing number of tourists.

Atherton Primary School has students from pre-school to Year 7 and has a special education centre on site. Its enrolment of 715 students, nearly double that of ten years ago, reflects population growth in the area. Thirty per cent of students are from families of low socioeconomic status. Indigenous enrolment (both Aboriginal and Torres Strait Islander students) accounts for 18 per cent of the total enrolment. About 20 per cent of the school's students need to travel to school by bus. A high proportion of students have computers at home, with somewhat fewer having Internet access.

The school buildings are 20 years old and set in very attractive tropical gardens. The 24 classes are mainly composed of single year levels. The three to five computers in every classroom, and seven in the library, are networked to a server in the library, using Apple equipment for ease of management. The school also has a set of 25 laptops with wireless connection to the server. An early decision in setting up the ICT program was to have it integrated with classroom learning processes and tools, rather than sited in a lab.

A notable feature of the server interface is its simplicity. Nicola Schulz, the school's teacher librarian and driving force behind the ICT program, has spent some considerable time in its design.

About 90 per cent of the teachers at Atherton use the learning objects as a conventional part of their classroom practice. They are less used in the pre-school and at Year 1 and 2. The Science and Studies of Society and Environment (SOSE) learning objects are those most commonly used. The Science ones, in particular, support teachers who don't feel strong in that area. The SOSE learning objects provide a very active learning process.

They are used in a wide variety of ways at the school, for example:

- Teachers introduce a unit of work or theme to the whole class, using a digital projector, after which students rotate through an activity cycle that includes using the learning objects.
- Students individually access the learning objects as part of a unit or theme.
- Teachers use the learning objects as a 'fun factor' for fast finishers.
- Students have open access to all learning objects in the classroom or in the library. It is notable that 80–90 per cent of all students in the library at lunchtimes, breaks or after school are using learning objects.

Our informants

Nicola Schulz suggested that, in her experience, teacher librarians often took the initiative in relation to ICT in schools. She stated that, in the mid 1990s, there was no escape from the need to come to grips with the issues related to digital literacy; and that while the professional environment encouraged that, she had not needed much convincing. She has had extensive experience as a consultant and, from that experience, has learnt that while new ideas need to be introduced to everyone, the greatest value comes from working with 'the keen ones' first to establish a base for wider interest and action, and that it's okay to leave the 'Luddites' for later.

When a regional ICT reference group was established, with a representative from each of the region's 16 school clusters, Nicola was the only member based in a primary school within the Atherton/Mareeba cluster. She was introduced to TLF's learning objects via initial two-day training held for the members of the reference group.

As leader of a Teaching and Learning project in the school's Tablelands/Johnstone district, Nicola applied for a grant for a project in which teacher librarians, who are resource managers, would take a key role in managing digital resources.

At about that same time, she decided as part of this process that there should be open access to digital resources. She noted that while secondary schools might need to arrange access by key learning areas, such an arrangement was unnecessary in primary schools, which emphasise integrated study. She was also influenced by the views of the teacher responsible for the school's gifted and talented students program, who had noted the potential of learning objects for accelerated learning and who had argued that to tie learning objects to specific units of work was too difficult and would reduce their teaching value, insisting that:

Pre-learning is always valuable and [the learning objects] can always be revisited. We don't [restrict] other resources.

Two of the major issues Nicola confronted in this early stage of introducing learning objects, were server storage capacity and accessibility for teacher and student users. She began with creating a school intranet site on which all the learning objects were loaded, in order to save teachers from all the download time. The school later adopted as policy that the material should be held in one central location that provided one-click entry to the learning objects. Nicola is emphatic about the importance of this idea.

Teachers don't have time to deal with problems of that nature. They must be given every encouragement to use the material and there should be as few technical barriers to that process as possible.

Later, a regional project to produce a CD through the Learning and Development Centre in Cairns proved very useful for teacher librarians as it provided access to large numbers of learning objects without having to download and store them.

Before the introduction of the learning objects the main uses of ICT at the school had been word processing, Internet and email use, and software mainly related to drill-and-practice routines.

The learning objects were promoted and discussed at the ICT committee, whose members include class teachers, the principal, the registrar, and a representative from the special education unit. Teacher members are 'block leaders' appointed from each cluster of classrooms. This group meets monthly, makes decisions regarding hardware, management of resources and professional development activities.

ICT professional development for staff usually occurs on site and is related to the integration of ICT into conventional classroom practice. For the last three years it has comprised short, skill-based responses to the needs stated by the teachers when surveyed. A Top Ten is established and once a fortnight the top ten issues are addressed at a 'Tech Café' held after school or a 'Breakfast with bytes' before school. These events are open to all teachers *and* teacher aides who are expected to work with digital materials. As well, 'block reps' mentor other teachers in the use of learning objects.

Nicola herself spent some considerable time 'playing' with the learning objects. She saw their potential immediately and was delighted and daunted that there were so many of them. She was well placed to manage their introduction. 'I could understand both the teaching and the technical side.' To further streamline teachers' access, learning objects are currently being catalogued using SCIS downloadable records and then hyperlinked directly to the school intranet from the library catalogue.

Some teachers check the catalogue to locate learning objects that might relate to the topic or theme they are planning to undertake, then familiarise themselves with the selected learning objects to see how they work and to review their content for usefulness and appropriateness. At other times, especially during planning days, Nicola promotes or advises on how particular learning objects could be used in particular contexts.

Nicola sees learning objects as delivering the following benefits:

- Their interactivity encourages a high level of engagement by students.
- The open-endedness of many of the learning objects stimulates further independent learning.
- The screen and interface are generally very clear and accessible.
- They are easy to access, to some degree a result of her own mediation and development of the easiest means of access for encouraging classroom use.
- The learning objects can be flexibly deployed across many areas of the curriculum for use by individual students, pairs, small groups, or (in association with a data projector) by a whole class.

Nicola notes that the school's Indigenous students in particular enjoy them greatly and benefit from their use.

She would like there to be more learning objects suitable for younger children and more that have Indigenous content.

We also spoke briefly to Rebecca Hamill, the teacher of a Year 2 class and a member of the school's ICT committee. She noted that her students come into class before school, to use the computers. They were currently using 'Making a movie' for which a number of students were using the more difficult version (the top level).

She selects learning objects by previewing possibilities and then comparing her planned learning outcomes to the object's capacity to provide for them. She mentioned a range of learning objects that had been highly useful in this regard. She likes their interactivity and commented on how the audio component supports weaker students. She also noted that more advanced students can find ways of using the learning objects to extend their understanding.

They cater for all levels. They're just great.

Nicola outlined the future issues for the school as being:

- maintaining the currency of the learning objects in terms of new releases, revisions and SCIS catalogue records
- accessing, introducing and using the digital resources that TLF is now releasing
- ongoing professional development for teachers
- extending students' access to learning objects by encouraging teachers to develop online content that uses learning objects.

Beechworth Primary School

Context

The main building of Beechworth Primary, built in 1875 and on the National Trust register, is set in impressive grounds. The school has about 210 students across Preparatory to Year 6, who come from the town and its surrounding area in Victoria's north-east.

Beechworth, about 250 kilometres from Melbourne, grew up as a gold-mining centre and now caters extensively for tourists. It has been a regional centre with a number of services – until recently two hospitals and a gaol, with associated employment – and is now the centre of a livestock farming community that is rapidly diversifying into other produce. The diversity of Beechworth's population has been increased by the arrival of quite a number of families who have chosen to live in the area for its considerable aesthetic attractions.

The school has eight classes, all composites of more than one year level. The students, almost exclusively Anglo-Celtic, come from a wide range of socioeconomic backgrounds. There is a comparatively high number of students with disabilities, some quite severe, who are integrated into regular classes.

The school's use of ICT has gained considerable pace over the past five years. In terms of hardware resources, there is a pod of six computers in the school's library and each classroom has computers – five in each of Years 3–6 classrooms and four in each of the Years P–2 classrooms. All are networked from the school's server along with a television network system that serves all classrooms. A technician, shared among a cluster of schools, is available to Beechworth one day each fortnight, a scheme that works well.

The cost of computer upkeep has been much reduced with the introduction of a new policy under which all the hardware in the school is of high quality and is turned over on a triennial basis. The ex-lease hardware is checked for quality and then sold off to parents at low cost – one reason for the computer ownership among the school's families increasing from about 30–35 per cent three years ago to about 65 per cent at the time of writing. (The new policy consumes one-quarter of the school's annual discretionary budget of \$100,000).

Observed activity

The Years 5–6 class we briefly visited had 28 students working in a significantly decentralised way. Individuals and small groups of students were engaged in wide range of activities related to their 'inventions', which they had shared recently at a forum with students from other schools. Many of them were working on their own business cards to give out.

Two pairs of students were working with the learning object 'Sports shoe'. As part of work on the topic 'Inventions', 'Sports shoe' was being used to help investigate issues such as how things work, how they are designed (including what factors need to be considered), and also to provide opportunities for explanatory writing.

As one of these students reported back to the whole class in considerable and accurate detail, in this learning object 'you design your own sports shoe'. First it is necessary to consider for which of four purposes you wish to design your sports shoe as users make their choices in those terms. You then consider the implications of your decision for the structure of the shoe – for example, the conformation of the upper, midsole and sole has to be considered in terms of factors like flexibility, grip and support. The shoe is then 'tested' (by checking answers for accuracy, using the appropriate template). If the 'five star' rating (all answers correct) has not been achieved, directive advice is provided about the requirements of the type of shoe chosen. Once the five-star rating is achieved, there is an opportunity to choose from three designs and a range of colours to finalise the product. The packaging can be adapted via naming and creation of a slogan.

The two boys in one group observed found this process very easy and in fact had invented their own form of game with the learning object. From the other group, an idea to develop 'real' 3-D packaging for a set of shoes was generated by its use. Both groups were absorbed in their activity and said how much they enjoyed using the learning objects. 'Fun' and 'learn better' were the reasons offered.

Our informants

Wendy Renshaw coordinates the use of ICT in the school. She is a very experienced teacher (25 years) and currently teaches the Years 5–6 classroom we visited. Her non-classroom tasks include preparation and supporting the implementation of the school's ICT plan.

She has been interested in the educational and other uses of ICT since the early 1990s when she encountered 'a computer in a box', a very simple game process, and shortly after got a Commodore machine and became excited by the possibilities computing seemed to offer.

It was green text on black background then. We did have a separate modem for Internet contact and we became involved in a global exchange project. We hooked up with a school in South Africa and began sharing information with them about our SunSmart program [a program designed to reduce the incidence of skin cancer]. We shared our policies and practices and they eventually adopted a policy similar to ours.

I could see the value in this for the kids, expanding their horizons in a way that seemed to reflect a real purpose. I have a very strong interest in making learning as authentic as possible – real, positive outcomes ... – and ICT offered the possibility of developing practice in this way. I am interested in looking at literacy in a different way via multiliteracies and multimodal texts.

I was very interested, self-motivated, and jumped onto whatever professional possibilities that came up. The networks at that time were just developing and I became a member of a computers in education group. I have become less involved in that because it has a strong metropolitan focus, which makes it difficult for people in the country. My networks are now more informal and include other teachers both within the school and from other schools close by.

For many years the content software she encountered was just more 'click and respond' and 'drill and practice'. This did not suit her approach to teaching and learning.

Wendy was introduced to TLF's learning objects about 18 months ago through her participation in the Primary English Teaching Association's 'Special Forever' project. She is emphatic about their need to be understood as *learning* objects.

They shouldn't be used as a wet-day timetable activity, just used willy-nilly. They have got to be perceived as related to learning, and this is part of the role of the teacher in their use, to contextualise their use and to relate them to what else is being learnt. I'd be worried if students didn't understand this, rather than just mucking around and having a good time with them. Making connections and having real purposes for learning is necessary. That's good use of technology in the classroom.

Since that time she has worked to introduce the rest of the staff to the increasing range of learning objects, through staff meetings and other local professional development opportunities. Turnover of staff, which has been substantial in the last few years, has created an ongoing need to revisit content that has been covered previously. She spends considerable time familiarising herself with the learning objects and checking what might be appropriate and useful for her programming.

Wendy likes the dynamic features of the learning objects, which are challenging for her students. The best ones, she feels, are 'really rich' as you can take the work off in many directions and some of them provide excellent opportunities for this. She is 'saving' some of what she feels to be the best of the Studies of Society and Environment learning objects for when she deals with related topics in the future.

She believes the advice offered about the 'level' of learning objects to be useful and generally reasonably accurate, although she recognises that many of them would be usable by students outside the specified range. She thinks that some of them can be too easy and that it is essential to find the right pitch and degree of challenge.

She likes the degree of independent learning they offer, but her primary reason for using them is the level of motivation they offer her students. 'It focuses them. The students get very engaged and stimulated, and then the learning objects continue to offer useful support for learning.'

Jill Nash, the school's principal, feels that the learning objects are excellent tools.

I love the way they engage kids and help them in the production of their work. They are so powerful in that regard. They are a great tool in our repertoire of engaging kids. The way in which the teacher takes the role of a guide is very much in keeping with the schools educational philosophy. Students are working at their own pace and controlling and being responsible for their own learning. We can use them across the board, and find them especially helpful with our integration students.

Our test results have shown improvement to at or above state average levels over the past year. The use of the learning objects and our focus on digital learning have been an important part of this. They have added strength and depth to our curriculum.

Beverly Hills Intensive English Centre

Context

Beverly Hills Intensive English Centre, an annexe of Beverley Hills Girls High School and on the same site, is located 15 kilometres south-west of Sydney's central business district. The Intensive English Centre is a highly distinctive school in many ways, not least because of the nature of its students and their rate of turnover. (There are 15 such schools in the New South Wales government school system.) At any one time it has an enrolment of between 130 and 160 students aged from 11 to 18 years. Students may directly enrol at the Intensive English Centre soon after arrival in Australia, or may be referred after approaching their local high school. They may stay as briefly as one term or as long as four terms, depending on their English language needs. Students stay at the school for an average of nine months before finding placements in mainstream schools or, for some of the older students, enrolment in TAFE institutions.

At the time of our visit the largest group of students was Chinese-speaking, but there were also large groups of Lebanese and other Arabic speakers. Many of the students are refugees from places like the Sudan, Sierra Leone and Somalia. There have been substantial numbers of Iraqis over the past few years. The principal, Michael Harmey, suggested that at any one time the school has some students who have had no previous experience of schooling, who have suffered considerable trauma including torture, and who have very high welfare needs. The school has 24 teachers, half of whom work part-time and most of whom have ESL training and backgrounds, and six teacher aides.

On entry to the Centre, students have a two-week reception/assessment period with subsequent class placement based on their age and language level. Each of the 11 classes has up to 18 students, although classes can be as small as four for intensive work with new arrivals. One teacher takes pastoral care of each class group. The strong focus is on English language acquisition, but framed to some extent to prepare students for attendance at mainstream schools. For example, the timetable reflects the conventional structure of subjects in mainstream schools – English, Maths, Science, HSIE, Music, Art and so on. But 'everything is an English class. We teach the language of the subjects with a strong in-fill of cultural information about Australia as well,' said Julie Ross, our primary informant. The program is a local version of what is termed by the Education Department an 'intensive English program'.

The Centre, consisting entirely of 'portable' classrooms that have been in place for several decades, has one computer room with 20 Macintosh computers, all of which are connected to the Internet. Each class is timetabled into this room for a double period each week. During this time the focus of their work is computer skill development. Michelle Yeo, the computer teacher, said:

Many students come to the school with limited computer skills, so we mostly do basic skill work stuff, working with AppleWorks and so on. Where the subject teacher wants to do something different, we negotiate that and work something out together.

However, that is not very common.

As use of the computer room is not timetabled on Thursdays, yet is accessible, it is used by subject teachers for various purposes. The five computers in the library are used quite heavily by students. All staff have access to computers and the Centre has an

expansive website that has a great many (non-interactive) teaching and learning resources developed by the school staff. The quality of hardware resources and networking is a bone of contention among staff. As the Centre has no budget for such resources, it has to rely on equipment made available by the host school. This situation may change shortly but, at present, digital learning at the Centre operates within fairly strict confines.

Observed activity

We saw a Human Society and its Environment class of fifteen 12- and 13-year-olds, a very diverse group whose dominant backgrounds were Chinese and Arabic. While their English language skills were not sophisticated, nor were they without any such skills.

The topic was 'The Rainforest Environment' with the outcomes sought being:

- Students can identify and label each layer of the rainforest.
- Students can read and respond to a simple information report.
- Students can complete a simple formatted text.

The lesson plan was:

- Recap on previous lesson, with vocabulary reminders.
- Hand out and discuss a set of worksheets.
- Set up the computer and navigate through the CD containing the learning objects.
- Talk and think about how long it takes a rainforest to grow.
- Name the layers of the rainforest.
- Label the layers of the rainforest and explain one identifying feature.
- Name three animals found in each layer.
- (For homework) Match the names of the animals to the pictures and colour them in.

And that is what happened. The learning object used was, helpfully, 'Rainforest'.

The class began in a normal classroom with a review of what they had done recently (an excursion) and reasons why some students had not gone on the excursion. All occasions for reinforcement of language skills were taken. The class then moved to the computer room where each student worked individually at their own machine, with a worksheet.

In terms of getting into the object, the students worked according to instructions from Julie. None had any difficulty in keeping up. The instructional style ensured that all students worked at the same pace rather than in a self-paced manner.

They spent some time going through the worksheet and its demands, using the learning object for source material. They liked the animation of the forest growing ('Wow that's good Miss. It grows. It's nice. '), and a moment of high excitement occurred when a wombat scuttled through the bottom of the page ('Hey look at this guy!'). They clicked on 'Layers' in a very guided process with lots of oral reinforcement. An opportunity was taken to explain 'facts' and 'true information'.

At the point of finding, identifying and naming creatures found in each layer the students did their own navigation and noticeably became more animated and began a certain amount of cross-talk with students nearby. One student who had been notably disengaged earlier in the lesson became very involved with the screen and began asking

questions. The class finished with a cloze exercise on the worksheet at which all the students were highly practised.

The lesson indicated that learning objects could be used effectively in a traditional teaching situation.

Our informant

Julie Ross was the class teacher we visited. She has an active interest in ICT and especially in their application in educational settings.

All kids want to work on computers. It's modern, exciting. They can be self-directing. A surprising number of students have them at home or where they live. Kids learn so much better if it's hands-on and active. I try materials out at home on my daughter and she's a very good guinea pig for what will work and what won't. I'm not good myself either. I know that anything that bores me will bore the kids too.

I came in contact with the TLF [learning] objects through the TLF New South Wales contact liaison officer. I had some time away from school and I was looking for resources on the Net. There were plenty but not as tailor-made as the TLF [learning] objects.

The ones I have used have provided lots to hang language study off, and that of course is a priority for our kids – by far their most urgent need. In some of the ones I have seen the [on-screen] language is too difficult for them. They need a great deal of scaffolding and support. So when I use them I do a lot of pre-teaching and use worksheets to reinforce what they are learning. They need the direction. It keeps them focused.

Brighton Primary School

Context

Brighton Primary School, with about 550 students from Reception to Year 7, is located in the southern suburbs of Adelaide, about half an hour's drive from the city. It is an older and well-established school in an older and well-established area with a substantially middle-class student body. There is a substantial group of Persian students and about 15 per cent of the enrolment are School Card holders (entitled to additional government support for economic reasons). 'Our parent group is very supportive, but they do have high expectations of student performance,' noted the deputy principal. About 90 per cent of the students have computers at home and about 85 per cent of students' homes are connected to the Internet.

There are 22 classes, all of mixed year levels, accommodated in buildings from various periods of the school's 125-year life. The site also contains a Centre for Hearing Impaired Students, some of whom are integrated in mainstream classes and some of whom work consistently in a specialist setting. The school has 43 staff including specialists for Physical Education and Music, with time allowances for staff who coordinate teaching and learning, numeracy and ICT.

The school is equipped with seven electronic whiteboards, which teachers have been trialling with great success. It has five computer pods, each having from four to ten computers, 12 computers in the library, and at least one computer in each classroom. It also has a lab with 20 computers, which is available to teachers on a booking basis. All the equipment is networked and all students have a password that enables their access to material relevant to their learning via Moodle, a learning management system that has recently been installed. This set of arrangements enables students to access the material from home, and in the view of Dave Henty-Smith, our primary informant, represents a significant step up from the previous arrangement (of using BELTS). Teachers access TLF's learning objects through an index organised by topic and year level. There is also an effective search facility.

Staff have been at work on incorporating digital learning in their classroom work for about two years. The school's staff has a substantial proportion of very experienced teachers who have been working at the school for a long time. Dave notes that 'a good number of teachers have taken it on board, although there are some who are less interested'. The approach taken was to develop the skills and interest of a core group of eight volunteer staff, one teacher for each year level, and allow development to percolate through the whole staff group. It is estimated that '70–80 per cent are now reasonably computer literate'. Participation in training and development activities has grown. On the most recent two occasions, about 30 staff attended. 'They see it working in junior primary and get interested.' Dave assumes on the basis of experience that it will, in the end, be the students who provide the pressure for changed approaches.

Observed activity

We saw a Years 6–7 class working on the theme 'Space'. The particular aspect being studied was the rotation of the Earth, the relationship of this rotation to 'day' and 'night' and to times at various parts of the globe.

The lesson began in the normal classroom with an electronic whiteboard, using the learning object 'Day and night'. There was a recapitulation of previous lessons and of what students had been learning, especially in relation to phases of the moon. One of the students used the board to follow the lunar sequences, with the class making predictions about what might occur at various points. The next task was then explained, including the need for students to think up a number of 'interesting questions' on completion of their work.

The students moved into the computer lab, which was located next to the classroom. Although a wide range of computer skills was evident, all the students were quickly at work. Everyone had something to do. 'You can see how absorbed they are,' Dave commented. 'Extremely involved.' This was true. Some students chose to work on their own, others in pairs. There was a great deal of on-task conversation as the students worked out times in various parts of the world according to the disposition of the rotation.

Most students got to the set questions, and several found inventive shortcuts to load and answer them. The pressure of time was evident – another class was booked into the lab. However, when the students went back to the class, questioning indicated that they had understood the fundamental ideas of the lesson.

We were also able to visit a Reception–Year 1 class to watch some of the students working with an electronic whiteboard. Their teacher, Deb Tune, indicated that she had used some of the Numeracy learning objects. Some of Dave's class had also been peer-tutoring this class using the learning object 'Make a movie'. This had been successful. Deb cautioned about an issue that has emerged at some other schools:

If they've seen it before, they say 'we've done this one,' and they don't want to go back to it.

However, she saw digital learning as helping with other learning supports.

You need to use [the learning objects] along with a lot of other stuff. But they are on task most definitely. In the computer room the children are very focused. They love the movement and action.

She also noted a change in the learning environment – a new demand for entertainment, the boys being part of the 'X-Box generation'.

Even so it is the girls who take the lead with work on the (electronic) whiteboard. We need to make sure that it is something different they are doing at school, and that learning and entertainment are distinguishable.

Our informants

Dave Henty-Smith teaches a Years 6–7 class at Brighton. He is also the school's ICT coordinator, a role that entails overseeing the working of the whole computer system, and organising off-site technical support and training and development activity. He is currently undertaking a graduate certificate in educational computing.

He became involved with digital learning when he was working in a country school where he had to take a 'relief' class based on computers and he 'didn't know how to turn them on. I thought I'd better do something about it.' ICT was becoming a significant part of life in this part of the country in terms of supporting both commercial and community activity and for communication purposes. From the earliest part of his initial experience, he was struck by the great potential of ICT for educating students.

It was just their capacity to engage the kids, the colour and action, and also the way they could help you visualise things that we were learning about.

He is of the view that learning objects allow students to learn in a more positive way.

It makes it easier for them. With the Smartboard (electronic whiteboard), everyone can have a turn and become involved that way. Students learn at their own pace and can focus on the issues they are up to. With the level of interactivity they include, learning becomes more like a game. They can report back on what they have done, but they also get feedback straightaway, which keeps them involved and motivated. With our Moodle set-up, they can generate a Word document, answer the questions they have been set and then send it to me online. They can and do access the learning objects from home.

They have also been fabulous for use with the hearing-impaired kids.

The only criticism of the [learning] objects I would have is that I would like more, and perhaps especially for junior primary students.

Distance Education School, Tasmania

Context

The Distance Education School is located in the northern suburbs of Hobart. It has approximately 200 students dispersed across the state and some others who are located (short-term) interstate or internationally. To be eligible for enrolment, students generally need to live more than 46 kilometres from a regular school, be travelling, or be located out of the state for more than three months. Some students are unable to attend regular schools because of pregnancy, because of particular medical conditions or because of school refusal or exclusion. The school is also the site of the Tasmanian Department's Online Campus, which has 700 students enrolled in subjects that are not available at their own school, languages other than English being one of the more common of these.

Students from Kindergarten to Year 10 are divided into groups based on aggregations of year levels, each with their own teacher. There is an average of 17 students in each group. Contact occurs through two half-hour group lessons each week, and a half-hour session for each individual. Those who are able to do so meet face-to-face once a year as a 'school' and more often in sub-groups for activities together. The school teaches subjects in all key learning areas. The teaching of languages other than English is contingent on the availability of teachers. Japanese is the language currently being taught.

The staple of the school's pedagogy remains text-based units of work, which are supplied to students along with the relevant resources. About 500 of these have been prepared by teachers and the in-house production centre. Group and individual contact with the students occurs through teleconferencing and also, now, through the Centra system, which provides, among other features, a video link that enables the teacher and students to see each other. Centra also provides a student learning management system that includes a capacity to record lessons so that students are able to revisit what occurred during the session. However, not all students have computers and some of those who do are not always connected to electricity – which makes extensive use of learning objects a challenge.

Teachers at the school review the learning objects for their own use and, when they find one that they think is particularly good or appropriate for a particular purpose, share it with the rest of the staff. The school's librarian also shares in this process.

The learning objects are accessible to teachers through the Tasmanian Department's portal and the school's Microsoft SharePoint-based intranet. Teachers who choose to do so upload relevant learning objects to the students' class resource centre. One of the major uses of learning objects has been for one of the school's two special classes. Our Learning Place provides specialist support for students who need extra help with literacy. TLF learning objects 'Picture this', 'Fashion design', 'Underwater discovery', 'Rap machine' and 'Space rescue' are among those accessible to these students. The teacher in charge of this facility is reported to find them very useful. Two other members of staff use various learning objects that relate to areas of current study.

Observed activity

We had been scheduled to watch work with a Year 5 student currently in Malaysia but he proved to be unavailable – one of the many challenges in providing education in this form.

Our informants

Pauline Samson who teaches Year 7 explained the system to us. She was very positive about the value of Centra to enhance the quality of distance teaching and learning. She had also found some of the learning objects to be of considerable value. She had recently included ‘In digestion’ in a unit on Wellbeing.

Phillip Campbell teaches the Years 3–5 group. It was his student we had missed observing. Phillip has been teaching for thirty years, for the last two of them in the Distance Education School. About a decade ago when teaching in a small primary school, he had decided to explore possibilities for online learning. He had thought that ICT could provide an opportunity to broaden the range of curriculum offerings and experiences in the types of schools in which he worked.

He came to TLF’s learning objects, of which he is an enthusiastic advocate, via the Department’s e-Centre. He thought at the time that they were ‘spectacular’ and well fitted to the purposes of educating the students he deals with.

They are usable in a variety of ways, which is important. They allow students both to collaborate and also to work at their own pace.

Phillip has used a number of the learning objects. In his electronic classroom, 14 versions of six learning objects were mounted and accessible to students.

They give students ‘thinking time’ and the procedural value is very high. Use of Flash (an application) provides those dimensions of interactivity and control, and then there is always the opportunity to revisit, which students can use to their advantage.

There is a huge benefit in that they are all quality-assured and can be used with confidence. There aren’t enough of them yet for everything I would like to use them for. The ways for us to think about using them include tailoring their use to the specific needs of individual students – and the [learning] objects and perhaps our capacities are not at that stage yet.

The motivation they provide is a very important aspect. Kids like the colour and movement but also they are ‘game-like’ and include the element of discovery. I find kids go back and are surprised by the details they didn’t find before and that gives them [the learning objects] a life [that] they otherwise might not have.

Eclipse Centre, Canberra College

Context

The Eclipse Centre is an annexe of Canberra College, located on the college's site in Stirling about 20 minutes drive south-west of Civic. For eight years it has been providing education for young people at risk. 'At risk' in this case means students who have been asked to leave mainstream schools (usually a number of schools), who are involved in the juvenile justice system, and/or who have a range of behavioural and/or mental health problems. These students attend the school on the basis of referrals from a variety of agencies such as Family Services, Juvenile Justice, and the police. The Centre also runs a program for young mothers (and their offspring). The students come from a very wide area unrelated to the location of the school. At the time of the visit the Centre had 93 students ranging in age from 13 to 21. The Centre has a team leader, three teaching staff and two assistants.

Up to 40 students attend on any given day, but numbers may be as low as 10. Attendance is not necessarily consistent. The types of contacts the Centre makes with its students vary enormously, for example, telephone, off-site meetings and visits elsewhere. Face-to-face classroom contact is not the norm. As Jan Marshall, the team leader noted: 'These kids generally have very complicated lives. They often come to school because it is the only stable element in their lives and the only contact they have with adults that is positive and supportive.'

There are three teaching areas. The central area has several rooms and a large open-plan area. One of these rooms and two parts of the open-plan area have about 40 networked computers, with little pressure on their use. In another room that resembled a computer lab, a brand-new electronic whiteboard had been installed just before our visit. There is another separate room upstairs, often used for the young mothers' play groups. There is a further wing with technical and industrial arts equipment, including access to computer animation. There is no shortage of space.

The Centre reviews its program regularly. Its goals include providing a transition process for students to return to mainstream schooling (which does not, however, normally occur) or to pursue further education in the Vocational Education and Training sector (which is more common). But the overarching goal is something much larger: to help students make changes so that they can live more productive and less pain-filled lives. Terms like social, emotional and physical wellbeing take on new significance when their absence is quite apparent. The staff shift their approaches frequently in an effort to explore new options for success. Jan Marshall says:

We are concerned also about proper accountability to the Department and the BSSS (the ACT's Board of Secondary School Studies, the relevant central curriculum agency). We want what we offer to be 'proper' programs and recognised as such. Our main task, at least initially, is to increase the level of trust that our kids can have in mainstream processes and in us, and that means trying very hard to develop an increased sense of individual responsibility and ownership of their actions. In this regard they come with a very wide range of capacities. They also have a very wide range of academic ability. Some are very capable; others are barely literate. That means being able to accommodate a 13-year-old doing quite sophisticated work, with an 18-year-old nearby who is doing some very basic literacy work.

A review about three months ago proposed significant additions and changes to the Centre's program, one of which was to institute new ways of using computers in the schools to provide personalised learning. The ACT Education Department employs Myinternet and its component Myclasses as its learning management system, which can be configured to provide a home page for each student. At the time of our visit, students at the Centre had been using these individual home pages for one term of ten weeks.

Each student's home page has some generic activities (reading the 'quote of the day' and reflection on it in a journal online; investigating a famous person, place or event; sometimes reading and commenting on an article that has been uploaded from the *Canberra Times*) that not only have intrinsic value but also help to establish a routine. Some students' home pages might have TLF's learning objects attached as part of those students' individual programs.

When students come to school now, often the first thing they do is to find a computer and log on to their own home page. Jan Marshall says:

They never 'lose' their work, it's there for them. Things are exactly where they left them. Many of the students do not have computers where they live. Those that don't live at home may be more likely to have access where they do live – in refuges for example. Their home pages are accessible from sources outside the school.

Jan notes:

Not all students enjoy working on computers. They just sit at the screen. Others can't follow the instructions without help. But we watch them growing in confidence, and it means that 'school' has become more accessible. Most of them love their home page.

One distinctive aspect of the Centre's work is the assessment process, which involves students presenting an account of their work in an interview situation to a panel of people from outside the school, to demonstrate they have used the ten weeks effectively. As well as commenting on the quality of what they have seen, the panel makes determinations in terms of placement (come back to school, come back to school but on probation, other placement or departure).

This process is designed to reinforce the idea that they come to school for themselves. They have to think about what they want to achieve, how they might demonstrate that, and how far they have gone towards that achievement.

Observed activity

Our visit occurred on the first day of students' attendance after the term break. Students were coming in sporadically until perhaps 40 were present by the time we left. Each student had a new individual home page to go to. Many, after catching up with their peers, went to a computer and had a look at what was there. Four groups (pairs and threes) were working on aspects of their home pages in one of the sections of the open area. (Research on dinosaurs seemed to be very popular in these all-boy groups.)

The main thing we observed, however, was the use of the learning objects and other home-page activities on the new electronic whiteboard. We noted the 'quote of the day' and the request that students reflect on it in their online journal. The theme of the further (main) work was 'Safety'. This theme had been developed into a unit with some footage from a school playground in the 1920s (part of the library of digital resources developed by TLF) as the centrepiece. The school playground material generated a very lively

discussion focused on comparisons between then and now, and stories about today's playground experiences. Four students were involved in this discussion. The home page included a worksheet related to this material.

We went on to 'Basketball clinic', a learning object that begins with a cloze exercise and then requires the sequencing of a series of statements. This activity was related to a Vocational Education and Training module on Sports Administration, which requires work on things like first aid, body systems and safety. The students were delighted to have the opportunity to use the whiteboard and follow it through, taking turns. One of the students had some minor difficulty with the sequencing process (an intuitive requirement) but was helped by the other participants. We spent about 20 minutes on these activities with all participants deeply engaged and others drawn to join in.

Our informants

One of the many interesting things about this case study is that none of the staff at the Centre is an experienced or dedicated user of ICT. Support has come from the original TLF contact liaison officer in the ACT, Lea Chapuis, and her successor, Mark Huxley. Both have spent quite some time with the school and have participated in its recent review processes.

Mark is very happy to be working with the school because the situation meets what he sees as the essential criteria for successful implementation:

- Adequate infrastructure
- Staff who are willing to participate, learn and make changes to their practice
- A flexible curriculum focused on individual learning
- Ready access to the learning objects
- An effective and user-friendly learning management system that allows for online forums, journal work, access to a wide range of digital resources and easy insertion of learning objects.

Jan Marshall has been at the Centre since its inception. She is a very experienced, primary-trained teacher. She describes herself as 'not a very proficient ICT user' even though she is the IT administrator. She comments on how valuable the support from Mark has been in this regard.

The technical skills of the staff were developed through active use.

We started about three years ago. I was dead scared we'd mess things up, break things, lose things. Eventually we got to be as good as a lot of the kids, or at least we could keep up. It felt like what we were doing was right.

Broad guidance was provided by the ACT Department of Education and Training's matrix for developing students' and teachers' competence with ICT.

Following our last review, we were concerned to develop and implement a really integrated curriculum, and we were looking for a 'hook', something we could build this around. That is what Myclasses and the learning objects has provided us with. It's a brilliant hook. We have found a really effective way to decentralise pedagogy and to provide something that really is individualised learning. The kids think they're having fun. They don't think of it as 'school'.

Jan went on to provide this qualification.

That said, the learning objects are valued as 'education' not as games. The level of (technical and presentation) quality of high-level games is way above that of the [learning] objects and despite this process [using the learning objects] being more fun, they are in no doubt that what they are doing is learning.

Jan first encountered learning objects at a system-sponsored professional development event designed to introduce teachers to Myclasses.

You need to take some care with implementation. It is important to walk kids through them [the learning objects] for a start, to get them used to working in this way. Maybe not for all kids, but with the types of kids we have, you can just add stuff. We have used 'Make a movie' that way and the kids are still going back to it, noticing and trying out new things. Then you might attach a worksheet and get them to go through that during the process or after they have finished. We like to have a bit of reading, then work on the object, then some response. We create units of work around the [learning] objects and find that they are remarkably versatile. They could be extraneous to a program; just fun to use by themselves. But in [our] case they are absolutely integral to the students' work.

What's good about them? The independence kids can achieve is phenomenal. Variety, motivation, flexibility, ease of use. The interactivity is very important. They get immersed, work at their own pace, re-read – we do notice this – go back and recover. Being able to repeat is very important. It is an additional incentive, which otherwise would not be there and which our kids need, to get things right. Most of [the learning objects] have fairly low demands in terms of text, which suits our kids. They enjoy the Maths ones because of the way mathematical concepts are translated into concrete situations. They love quizzes and multiple-choice activities. They can get success very readily and obviously that way. Some need to be talked through. They skim, and miss points that they have to take account of.

If [after this experience] I went back to the classroom, normal classroom teaching, I'd be teaching my classes like this. There is no way I'd be going back to what things were like before.

Good News Lutheran Primary School

Context

Good News Lutheran Primary School (GLNS), located in Middle Park, a western suburb of Brisbane about 15 kilometres from the city centre, is about 20 years old. It has 430 students and two classes at each level from Preparatory to Year 7. Eighty per cent of the students live within four kilometres of the school. About 15 per cent of the students, many from Asian or African countries, have a background of English as a second language. Most students have computers at home with an Internet connection.

The school has a very active and involved parent group who have a comparatively high rate of employment in the professions. Given the scale of investment required to set up the school's ICT infrastructure, the parent body has been not only supportive but has helped drive the school's focus on ICT by agreeing to a special levy (equal to 20 per cent of the annual school fee).

Sam Bandidt, director of the school's Centre for Applied Innovation and eLearning, manages ICT within the school. The Centre has five focal points for its work within the school: infrastructure, curriculum, pedagogy, training and research.

In terms of infrastructure, the school has two computer labs with 30 machines in each. Each classroom has between five and 14 computers, with 60 wireless laptops available for use within the middle school. All machines are networked and run in a thin-client environment. The student to computer ratio sits at less than 2:1.

Sam believes that Queensland schools do not have an ICT curriculum that is responsive to the needs of students. The school has worked on the development of its own understanding of what is valuable in this area and developed an outcomes-based ICT curriculum framework covering levels 1 to 5. The P-3 teaching of ICT is fully integrated into the wider curriculum and delivered in a team-teaching mode with both classroom teachers and the eLearning integration teacher taking an active role. At Years 4-7, ICT teaching takes place not only within the integrated curriculum but also in the form of discrete ICT skills. All teachers have a co-programming day once a term with the eLearning integration teacher.

An early issue to be faced was the pedagogical changes needed for including ICT as a conventional classroom tool for teaching and learning. One of the challenges in this area has been to overcome teachers' concern that the infrastructure will be unreliable and inconsistent. This has been overcome through the synergy of highly reliable equipment and effective ICT management. Familiarisation through regular use has been supported through measures like putting the daily notices online.

Training in the use of ICT has been a focus of staff professional learning. The Centre for Applied Innovation and eLearning manages its own ICT professional learning centre called iTEC. iTEC provides structured professional learning for the school's teachers in two areas – personal ICT skills and professional elearning implementation skills. Courses are predominantly led by teacher practitioners and are delivered in face-to-face, online or multimodal formats. Workshops have also been conducted for parents, who are also given opportunities to explore TLF learning objects. This has brought forth a very positive reaction.

Observed activity

We visited one of Janelle McKibbin's classes where 11 students from Years 4 and 5 were receiving intensive numeracy support. She sees them for an hour per day, four times a week, and is responsible for all Maths planning and implementation for this cohort. 'They struggle with the conventional classroom work, and this time provides an opportunity to develop their skills in an environment more tailored to their needs. They respond very well.'

During the visit, we observed the students engaged in variety of inquiry-based activities in small groups. Most of them were working on laptops using several of the learning objects. Each group was deeply engaged in its tasks. The group at one table was using 'Wishball' (a game-based learning object relating to place value and estimation), which they liked very much. All three students in this group were able to describe the mathematical processes they were using to get the right answer and demonstrated that they had developed effective strategies for manipulating numbers and their place value.

Our informants

Sam Bandidt has been at the school for seven years. He has had a lifetime interest in ICT. Both his parents have been involved in computer education. He trained as a teacher before working as a research assistant at Nottingham University and later taking a higher degree at Griffith University where he also worked for a time.

Sam encountered the learning objects via distribution through the Lutheran schools network and became involved in the trial process. He believes that the learning objects have filled an important gap.

A lot of our software previously has been American with a drill-and-practice base. The [learning] objects are more open-ended and interactive as well as related closely to Australian curricula.

When we initially saw the material it was on a CD with no directions regarding use, targeting or control, so we have had to address those questions.

Some of the considerations that guided the thinking of the school's staff were that learning objects should be used in an educational context and be used for a particular purpose other than a time-filler. It was decided that learning objects would not be openly accessible to students as otherwise they might lose some of their appeal and interest; and as the teachers should be judging how to use the learning objects to optimise learning.

All learning objects are, however, accessible to staff through the school's digital resource library (LOOP, the Learning Object Organisational Portal). The digital library has been developed to organise the ever-increasing number of digital assets, including learning objects. Staff use the digital library to conduct keyword searches for electronic resources. The results can then be incorporated in the schools online learning environment (Moodle) for structured and targeted delivery. Teachers can also build on the digital library by adding their own links to websites or other digital assets.

Janelle McKibbin is a teacher who provides intervention for Years 4 to 7 students who need support with literacy and numeracy. She has been at the school for five years. Although her training did not take in any ICT, she had some exposure to use of ICT during her first teaching appointment. At GLNS, she notes, the quality and range of the equipment, and support in its use, has meant that adoption of its use is hard to avoid.

The arrival of the learning objects, in particular, stimulated her interest and involvement.

In August, the school was 'highly commended' in the National Literacy and Numeracy Week awards, which 'recognise school communities for the outstanding work they have undertaken to improve students' literacy and/or numeracy outcomes'. The highly commended entry had shown how students' performance in the numeracy intervention program had been carefully tracked over a three-year period. In particular, the research focused on change in pedagogical practice and how it had enhanced learning outcomes. Janelle McKibbin suggests that the introduction of an elearning focus, and in particular the use of learning objects within her teaching practice, has been one factor accounting for the intervention program's success in this regard.

The students I work with have a wide range of learning difficulties and sometimes have poor fine motor skills. The learning objects provide huge motivation. Most children today are 'digital natives'. 'Wishball' and 'Dream machine' are two [learning] objects that have had a lot of impact. The kids love using them.

One of the major issues for the students I work with is finding the right starting point to enable them to learn effectively. In their normal classroom work the entry level is often too high. Through using the [learning] objects I find that we can progress at a much faster rate through the syllabus and content we want them to master. When using the learning objects the students are highly motivated and engaged in the learning practice.

Janelle McKibbin also notes that it is vitally important to ensure the learning objects are nested correctly within her planning.

To gain maximum learning benefit from the [learning] objects they must be incorporated seamlessly into a lesson. I often introduce the learning objects to the whole class using a digital projector. As a class we work through examples of how a learning object is used before the children begin working individually. That way, class discussion is generated.

The learning object is used to enhance or consolidate a concept being taught in the classroom. I find that the [learning] objects are very accessible, with the children having no difficulty in being able to understand what is required of them. We have regularly used [learning] objects relating to areas of numeracy like rounding, area and fractions. 'Wishball' never fails. I would like some more relating to 'money'. In fact I'm looking forward to lots more coming out.

I find that with our digital resources, I can relate the work to real-world situations much more easily. I was working with greater than six-digit numbers, for example, and we were able to monitor Australia's population growth. We had a look at a website recording Australia's population growth and I asked the students to estimate what the population might be at a particular time. Using skills the children had been taught they were then able to check the real figures for this online.

I think the learning objects are important for motivation obviously – and their audiovisual nature is important for that – but also for their capacity to reinforce learning. Content-wise, the only issue is, when can we have more?

Jingili Primary School

Context

Jingili Primary School in the northern suburbs of Darwin is just over 30 years old. While during some of those years its enrolment has been as high as 600, it is now about 180 of whom 60 are Indigenous students and 48, mostly from Asian countries, learn English as a second language. It draws from the local area, which is, for Darwin, comparatively old. Its residents are employed in a wide variety of ways – ‘a great mix’ as described by Eva Lawler, the school’s principal.

The school has eight multilevel classes from Transition to Year 7. On the expansive site there is also a child-care centre and a pre-school. The school itself has 14 teachers, which includes support teachers for students with disabilities and the ESL enrolment. As a local initiative, the school has also chosen to have a 0.7 (full-time equivalent) Information Literacy teacher who works with each class in three one-hour blocks and who also reviews and provides advice about digital resources. Work with ICT is integrated in various ways in almost all classes. The computer teacher co-plans with the classroom teachers and works with them, for example, by taking half a class to the computer lab housed in the school’s library and then swapping groups with the class teacher half-way through the session.

The lab in the library has 20 computers and each classroom has two or three. Although all computers are networked, the cabling system is not very reliable and needs replacement. The school is currently seeking funding to upgrade its hardware and cabling. The Information Literacy teacher helps with trouble-shooting and, as well, a technical assistant funded by the School Council provides support one day each fortnight. In addition, a member of the front-office staff has ICT skills that prove very useful. Every teacher has a laptop computer provided by the Northern Territory’s Education Department.

In the department’s schools, the learning objects are directly harvested from the LeX and then subsequently published into Explore NT (the department’s curriculum resource repository) in categories that enable both searching and browsing by the end-user. About 300 learning objects are currently available, somewhat fewer than are in wider release.

Observed activity

The Information Literacy teacher was ill on the day of our visit but 18 members of a Years 4–5 class were scheduled to use the learning object ‘Taste and smell’, part of the Science suite of material, as part of the school’s unit on Science in the Kitchen. The students were working with a digital learning sequence that was to be accessed via the Education Department’s customised version and local installation of BELTS (the Basic E-learning Toolset developed by TLF). This version of BELTS was released as a result of teacher feedback on the strengths, weaknesses, opportunities and threats to the BELTS system, when it was piloted in 2004. The digital learning sequence had 11 elements drawn from various sources, with the learning object as the culminating element.

Unfortunately the students, who were very patient, were not able to load the object. Initially it seemed that it was simply slow to load but other technical issues caused a system freeze. They moved on to work with Inchain's Marvin, presentation software that the students were using as part of their English program.

Our informants

Judith Armstrong, the class teacher to whom we spoke briefly, said how important it was for students to develop ICT skills for dealing with their digital environment. She noted how much the students enjoyed using computers for learning, and the value of the Internet for research purposes. The school aims to prevent students accessing sites that are of little value, through keeping a hot list of such sites.

We spoke to Eva Lawler at greater length. She reiterated Judith's point about the significance of developing ICT skills in a world where almost everyone has to work with computers at some stage or another. Eva is convinced of the educational value of ICT, especially in relation to their impact on students' motivation and engagement – 'We never have any behavioural problems in the lab.'

She felt that the school was 'behind' in this regard when she arrived a year ago, when students' ICT skill levels were comparatively low and the integration of Learning Technology outcomes into teaching and learning programs was minimal. The school has subsequently decided, in broad agreement, to accelerate progress in ICT, commencing with a concerted effort to increase levels of confidence and skill among the teaching staff.

The professional development process designed for this included some intensive support for six of the teachers. Every teacher has a 'buddy' staff member with whom they share their work and knowledge. After familiarisation with the system each teacher will design a digital learning sequence to share with colleagues before the end of the year. At staff meetings teachers share the learning sequences they have developed.

Eva indicated that the school would benefit from access to more learning objects so that each key learning area was well served. She added that one of things all the teachers would appreciate is infrastructure that works first time every time.

Kormilda College

Context

Kormilda College is located on expansive grounds in Berrimah, once a small settlement between Darwin and Palmerston but now part of the Darwin conurbation. The school was established originally as a government boarding school for Indigenous students from remote communities who otherwise would not have had access to secondary schooling. It is now run by the Uniting and Anglican churches and has a substantial non-Indigenous enrolment among its 900 students. It still has a large boarding component with between 180 and 250 Indigenous students. A number of other Indigenous students from the Darwin area attend as day students. It provides programs across Years 7 to 12. The school has a reputation for good academic results and strong pastoral care. There are 75 (full-time equivalent) teachers at the school.

Kormilda has been in a process of restructuring for some years to ensure that it provides the best possible education, especially for its boarding students who have to deal with the adjustment of leaving home and community and who often arrive with interrupted schooling and quite low academic skills. Many of these students are EFL/ESL speakers who have low levels of literacy in English. As a result the school has set up a faculty of Intensive English, and classes are structured at various levels to ensure that students' needs are met. Smaller classes are provided for students with the highest levels of literacy need (those with performance measured at pre-Band scale to Band 3); and, at a second level, the school provides supported English classes for students whose literacy skills are only about one year behind mainstream levels.

The school has three full-size computer labs, one half-size lab, and two class sets of mobile wireless laptop computers. There has been a general shift in focus from 'doing IT' to using ICT across the curriculum without any special timetabling for it. One of the difficulties with this approach, however, is ensuring enough computers for staff use. While there is a bank of computers in the staffroom, not all teachers have access to computers at home, a circumstance that constrains broader classroom use. There are, however, staff who are 'passionate' about ICT (including the head of the Intensive English faculty), but whole-school adoption has not yet been accomplished.

Indigenous students are enthusiastic and capable users of ICT. While they often don't have computers in their homes, they have had access through community facilities. It has been noted that students with lower levels of literacy, perhaps inevitably, tend to skip text instructions and work intuitively – which is not always successful.

Access to the learning objects, previously obtained through the Territory's Education Department, is now direct, as the school has acquired TLF's CD-ROM.

Observed activity

We saw a Year 9 Humanities class of 17 students working on a learning object related to landforms and their creation. This was a 'supported' group (see above), some of whom had missed substantial portions of schooling, but a number of whom seemed to be quite capable. Jan Thomas, their teacher, noted that many of them had literacy levels approaching those of the mainstream classes. Although they didn't all appear to be

highly practised computer users, they had the skills required for entry to the learning objects and subsequent navigation.

There was an initial problem with access to the learning object. As there had not been sufficient time for the learning objects to be uploaded onto the college server, a Microsoft PowerPoint presentation had been created to enable access, and had been uploaded on all 20 machines in the lab. However, due to a technical glitch, it had to be reinstalled.

The students were introduced to the task to be completed on the computers, along with a task sheet. The pressure of time was evident (as we have observed in many secondary classes). About a quarter of the students chose to work in pairs and many others worked collaboratively with other students.

The learning activity provided via the learning object provided information and practice for a unit of work created by Jan Thomas, using the 4MAT system of instructional design. Access to the learning object, which was a problem, was achieved for more than half of the students with the help of Karen Shum, the school's Teaching/Learning Technologies teacher who was working in the room.

The object is designed to help students understand deposition and the various earth movements (faulting, folding, extrusion) that produce landforms, through constructing their own copies of geological cross-sections. It is a comparatively complex learning object with several working areas on any screen and quite a lot of text instruction. This object is less intuitively organised than are some others, and the concepts it deals with are abstract.

The first task requires an important step of logic as the user must begin by creating layers and then introducing a fault line to achieve the correct result. Because most of the students first attempted the task intuitively (by filling in the coloured sections one at a time), they had to be shown the first step, after which they found the tasks comparatively easy. It is possible that they were learning more about computer navigation and pattern reproduction than about geology.

The circumstances were not ideal. It would have been easier and more effective to have had a more relaxed and detailed introduction to the notion of geological formation prior to the use of the object, which our visit and the circumstances of the learning object's use did not provide for. But most of the students became engrossed in the task and at least half became adept at recreating what was required. Some were also able to describe or remember some new words they had learnt, for example, 'deposition', 'sandstone' and 'conglomerate'.

When asked about the value of learning via ICT in this fashion, most but not all students were convinced of its value. The positive comments included, 'learn more stuff this way', 'better than writing it down', and 'sort of just enjoyed making the shapes'. Two spoke up about their preference for other sorts of learning. 'I like to copy from a book. You can go back to it.' 'I like to have my own work.' This latter point was discussed later in the context of these students' wish and need to have a concrete record of their work, and the absence of Save and Print functions in the learning objects. 'They do like to show their work. That is very important to them', Jan Thomas noted. We talked together about the value of a Print function for these students.

Our informants

We spoke with Karen Shum, Elsabe Bott and Jan Thomas.

Jan is the class teacher of the group we observed at work and for whom this was a very early experience in working with TLF learning objects. Elsabe is the school's director of studies, who was acting deputy principal on the day we were there. She provided much of the information contained in 'Context', above.

As noted earlier, Karen is the school's Teaching/Learning Technologies teacher. Her responsibilities include supporting the use of learning technologies through the curriculum, providing professional development and classroom support, and general problem solving. (Another member of staff has responsibility for technical maintenance and support.) Karen has found that the most effective form of professional development, for integrating ICT into the curriculum of all learning areas is 'to have guided support'. Staff have been supplied with the TLF catalogue and Karen is willing to assist them in finding the most relevant learning objects for the units of work they design.

She thinks the strengths of the learning objects lie in their offering:

... an independent package. It's all there you don't have to [go to] alternative technology sources to find what you need. They are easy to access and use. You can complete this kind of learning experience in one period, and then move on to other things. They're good for motivation and developing an interest in the topic.

Other students had gained access to 'Rap machine' and enjoyed the experience. Karen also commented that 'Gold rush' could be an excellent object, given its interactivity and variety of learning experiences.

Lowanna College

Context

Lowanna College in Moe opened as a new single campus in 1998, the product of an amalgamation of three secondary schools at the western end of Victoria's Latrobe Valley, 130 kilometres east of Melbourne. The college has nine feeder primary schools, some a considerable distance away in small rural communities. Lowanna has about 1200 students enrolled across Years 7 to 12, who are from families of middle to lower socioeconomic backgrounds. About 80 per cent of students have computers at home, while about 60 per cent of those have Internet connection.

The student body is divided into three sub-schools – Years 7 and 8, Years 9 and 10, and Years 11 and 12. This structure is currently under review with consideration being given to revising the structure to Years 7–8, Year 9, and Years 10–12. Lowanna has about 100 teachers.

The college has excellent facilities, including a 550-seat auditorium with a recording studio in its control centre and a very substantial gymnasium. Both these facilities are extensively used by the community. The college has a strong focus on teaching and learning and is currently undergoing significant development in changing teaching practices, especially in the areas of student engagement in learning, integrated projects and student-centred learning. Lowanna offers a full range of Victorian Certificate of Education subjects at Years 11 and 12 and a substantial range of Vocational Education and Training studies, one of the reasons for its drawing power.

The college has a very sophisticated ICT system with a high-speed wireless network throughout, and a sophisticated Internet portal that is accessible from all computers in the college and from students' homes. It uses a Microsoft SharePoint portal learning management system for student home pages, staff home pages, teachers' resources and documentation, all curriculum content, general college information, the college's calendar, college news and ICT services.

Every classroom in the school has at least six data points and wireless connection. The library has 26 computers. Four specialist computer labs each have 25 machines. Six areas that are partly computer labs, and several classrooms, each have a small number of computers. The school also has a team of four full-time technicians for technical support. Before 2003, the technicians estimated that they spent about 65 per cent of their time trouble-shooting. They now have a fully automated network, which has enabled technical support time to diminish to less than 5 per cent, allowing the technicians to spend considerable time with teachers who are working on curriculum development.

TLF's learning objects are accessible through the teachers' resources section of the portal.

Observed activity

We watched nine Year 7 students, a group from a Humanities class, at work in one of the computer labs. The topic was 'Water' – its use and conservation.

The class began with the teacher's oral recapitulation of material previously examined. It related to the amount of usable freshwater water on the planet, with an emphasis on the very small amount available.

The students then read an article from the local paper about re-use of industrial water, which Betina Sho, their teacher, had uploaded and inserted into the class's online program. They were asked to respond to the question, 'How do you think this will benefit our community?' by typing a short answer and then sending it to Betina online.

Then, after recalling some ideas they had discussed previously about what damaged waterways, the students individually listed ten damaging agents in a file that they each forwarded to their teacher's computer. She was able to check that they had done so and able to put some of the students' responses on the screen for their authors to read to the whole class.

The learning object used was 'Uncle Bernie's pond'. It entails reading and listening to ideas about returning pond water to its previously pristine condition. A number of options are presented for students to choose. Along with immediate right/wrong feedback, advice is offered about the implications of the choices. Betina had added a test, using NetOp's Class Server, for the students to then check what they had learnt. This test was automatically marked and the results forwarded to Betina.

The students were mostly very engaged during this process. Several repeated work on the object prior to going to the test. They all agreed that they enjoyed working this way. When asked about what they liked especially, the answers were those to which we have become accustomed: 'easier than just reading', 'you pay more attention', 'it's more interesting', 'it's fun'.

Our informants

Greg Gebhart is the college's manager of multimedia and information technology. He has been at the college since its inception and has played a major role in establishing the school's ICT set-up. The college has recently implemented a new knowledge management system, which has been developed with the help of staff and students. For example, quite recently, as part of the college's major focus on 'teaching and learning', students' opinions and ideas were canvassed on what they wanted the school to be like, what facilities were needed, and what makes a good teacher. The views of the college's staff have been elicited on how ICT resources should be configured in the school, especially in classrooms, to provide the best possible support to staff. Although great progress has been made, the school is still working on these issues.

Greg began his teaching career in Physical Education. He became involved in computing some time ago when he began a basic course in computer use and was asked to teach two computing classes. He has since undertaken several postgraduate studies in computing. Over the past seven years, Greg has undertaken part-time secondment to Monash University and more recently to NetAlert. He has been very active in developing business partnerships (for example, with Dell, Microsoft and InLearning), which have been of great benefit to the school in terms of hardware, software and training.

Greg stresses the importance of the contribution of ICT as a learning tool rather than as an end in itself, and that this is the approach the school has adopted. One consideration in the development of the school's facilities has been to make teacher access as user-

friendly as possible. Using the college portal, every teacher can create and publish curriculum content without having to know how to design web pages. Providing teachers with ownership has been paramount.

We want people to understand that they can manage it themselves. Our job in technical services is to service their needs and to make the process as easy as possible. That is as important as any other issue. We asked teachers, 'If you were going to put content online how would you like it done?' 'What sorts of categories would help you best – for example, class-based, KLA-based, year-level-based?' The result has been an extremely extensive range of teaching resources that is easily accessible and provides every teacher with input into the design.

Greg is concerned that many students have only limited access to technology in classes because their teachers have not changed their teaching practices to incorporate technology as another learning tool. He is also concerned that, while schools and the government have focused on hardware and software for education, the need for significant professional development relating to ICT is not being serviced as well as it could be.

How do you get learning objects used? In part it's just a matter of getting teachers to have a look at them. They're very attractive. You can see the possibilities quite readily. But that process has to be driven by leadership and modelling. We have to show we're serious about these learning resources.

Betina Sho, a Humanities and English teacher, is comparatively new to the school. She has returned to teaching after having qualified as a teacher some 15 years ago. Greg asked her to become involved in trialling Microsoft's SharePoint portal, NetOp's Class Server and TLF learning objects. She thought, 'This is great. This is something I can learn how to use.' With support from one of the school's technicians she developed her computing skills both generally and in relation to the school's resources. She spent a holiday period going through available resources and thinking about and collecting material that she thought would be suitable for her classes. She worked her way through developing and managing content and other technical issues and now has a large bank of planned resources and learning sequences that she uses as appropriate in her classes. She uses the computer labs for about one in four of her class periods and at times in the normal classrooms she uses her laptop computer with a data projector – to begin discussion, for example, to provide information, or to introduce learning objects or other digital resources.

I can find all sorts of uses for the learning objects. For example, I used 'Dream machine' as a transition to a writing exercise. Students had studied some ancient cultures and I wanted them to write about an imagined culture focusing on a series of factors ... They needed to get to this imagined world, and the dream machine was the vehicle.

It's definitely more interesting for the kids. There is an immediate level of motivation. They get very excited about their results. They want to achieve more, and improve. And that is unusual for the sorts of kids I have in my classes at the moment. Many of them are not usually very enthusiastic about school, and a number have quite severe behavioural problems, but their attitude has improved significantly, and I'm sure their online learning has contributed to this. You get much higher levels of concentration and application.

Some of the [learning] objects are fantastic. They definitely improve student learning. They're not just filler or games. All have educational value; it's just

a question of how you use them. For Years 7 and 8 (Betina's main classes) they are just fantastic.

Mona Vale Public School

Context

Mona Vale Public School, in the heart of Sydney's northern beaches, has been a primary school for students from Kindergarten to Year 6 since 1911. It has 830 students, 30 classes and about 40 staff. It has two classes for students with intellectual disabilities, and a Language Communication class for intellectually disabled students who need additional support for complex problems. It also has two 'opportunity' classes for students who have tested as having high levels of intellectual ability. For many years the school has had an 'enrichment' stream for selected students, at each year level from Year 2.

Despite the school being located in an area with very expensive real estate, the students are described as being 'a very mixed group of kids'. There are students who come from extremely wealthy families and others whose parents are described as 'battlers' – long-term residents in rental properties. Strong levels of parental support are reported. Within the mainstream classes there is a wide range of abilities that includes students with learning difficulties. A group of students for whom English is a second language, and whose backgrounds range from China and Korea to Scandinavia, are supported by an ESL teacher. In one class we visited, the students were learning some Finnish as they had a Finnish classmate.

While the previous principal had been in the role for 28 years and the staff is very stable and experienced, the school is going through a period of considerable change at present. Most of its administrative team changed at the beginning of last year and many new initiatives are now in train.

Physically, the school is a sprawl of buildings set in very attractive grounds. It has a computer lab with 30 computers. All classrooms have at least one additional computer and many have more, averaging about three, all of which are networked to the school's server. This server's repository has a wide range of digital resources, but until the introduction of TLF's learning objects, they consisted largely of 'drill and skill' software.

The major effort at the moment is developing the use of electronic whiteboards. Two teachers have piloted their use for about six months and reported very positively on their experience. This has attracted the interest of other members of staff in the use of ICT in the classroom. Fourteen additional boards are either installed or in the process of being installed. Negotiations are ensuing to secure another 10.

All students in the Year 5 class indicated that they had at least one computer at home, some had more, and only two lived in homes without Internet connection. It was quite evident that their computer skills were well developed.

Observed activity

We watched two classes using TLF learning objects.

The more extended period was spent with a Year 5 class, one of two lower-stream classes, with 28 students present, four of whom were students with disabilities who were integrated into mainstream work. When we arrived the class was divided into two

groups. One group of 10 was on a mat in front of the 'Promethean' whiteboard which can be operated via the computer keyboard or mouse, 'pens' on the board or a slate. The latter two controls were in use. The students were working on compound area of rectangles via 'Counting with Coco'. The idea of 'length x width equals area' and then adding the totals of different connected rectangles was rehearsed. The students were avidly waiting for the use of the object. Their attention was strongly focused when they began using it. Screen text was read out by one or more students and then the task and procedure were discussed as they occurred. This group seemed to get the hang of this quite readily. They then moved on to the area of a triangle using the same object we had seen in action at Southern Cross (New Zealand) with Year 8 students (see later case study).

This group worked by themselves on this task – very happily, cooperatively and effectively – while the class teacher worked with other individual students elsewhere in the classroom. It was evident how easily the work with the learning object on a whiteboard had become embedded in what appeared to be conventional pedagogical process in this class. 'Let's get a new triangle.' 'Someone else's turn with the slate now.' 'Can you spin it [the triangle]?' (This spinning was required as part of the object's procedure for placing elements of the copied triangle into a rectangle, but it wouldn't work. We saw something like this happen again in another classroom, which implies testing of learning objects must now cover whiteboard use.) A very high level of engagement was evident.

For the sake of our visit several other learning objects ('Vile vender', 'Sludgy sludger' and 'Foul foodmaker') were accessed (the class had been doing Chance and data), each producing cheers as they were discussed. Several observations can be made about this. One is how easily accessible the learning objects were in this context. After only five weeks of using the learning objects, the students could find them on the server and bring them up quickly. Another is the students' evident pleasure in returning to material they had previously worked with (Area, and Chance and data, are not always thrilling topics for Year 5 students). Chris Painter, the teacher of this class, drew our attention to the effective learning obtained through rendering the derived values in various ways (fractions, percentages and decimals). She noted that this was also a valuable aspect of 'Wishball' and other numeracy learning objects.

We then went briefly to a Year 2 class that was working with 'Catch a thief', a learning object that supports literacy, which has a strong focus on observation, evidence and recall. Here, too, students were working with an electronic whiteboard (a 'Smartboard' that works on a finger-touch basis). We had previously seen this learning object being used with a Year 9 class. The learning object's vocabulary is challenging for a Year 2 class, but they were handling the general procedure and thrust of the object quite comfortably. It was being used in the manner of a 'big book', the teaching process employing lots of unison reading and explanation of hard words. (One student suggested clicking on the hard words to see if they were explained. They are sophisticated users of ICT. As it happens, that technique does operate in some parts of the object.) For this group of students the graphic and animated elements of the learning object secured their attention most strongly, but it was interesting to see quite young students using an object of this nature.

We returned to the Year 5 class who had by then been joined by their Kindergarten 'buddies'. This time they were using 'Dream machine', another literacy support object focused on metaphor and simile. From a range of options, users (in this case the 'buddy'

pairs of students as elements of a larger group of students) choose a frame, pedals, gears and chain, handlebars, wheels and a seat for the 'dream machine'. There was a significant challenge in coming up with a consensus about the nature of the choices, but things generally proceeded without uproar.

When these students were asked whether or not they liked working with the learning objects, there was unanimous agreement. When asked why, there were the customary reasons: 'it's fun', 'it helps learning', and they enjoy the animations. They suggested, '[use of the learning objects] makes you want to learn things', and interestingly 'you can go backwards and forwards to things'. These students also liked the big screen.

Our informants

John Bladen is the principal at Mona Vale. He has had wide-ranging educational experience including a period spent as a member of the Education Department's senior executive. He is most enthusiastic about the incorporation of new learning technologies in the school and has led the drive for the installation of the whiteboards. He is also thoughtful and considered about their value. Their strong points, he emphasises, lie in how they can increase students' range of learning experiences and especially the collaborative activity they engender.

I got interested originally because I thought they were something that might encourage the engagement of boys given their propensity for interest in toys like this. But it hasn't turned out this way. I never thought we would have half the kids doing what they're doing with technology today. Like anything else educational, they are only as good as the people using them. They must see a real purpose for it; otherwise why use it? But we seem to have got past that point. New tools, new repertoires of practice.

Chris Painter, an assistant principal at the school, is also the class teacher of the Year 5 class that we observed. She has spent some time as a 'Linkages' consultant focusing on quality teaching and learning for the Education Department.

She has had a long interest in ICT in education going back to Microbees. Why?

It was there and you use it. It is part of the continuum of learning. I was just doing my job, keeping up with the understanding of the lives and expectations of kids today.

She hasn't undertaken any special formal training but has learnt with and from her colleagues. She investigated new software and remembers using 'Murder under the microscope', a very early Australian-made learning object.

She is a very strong advocate of TLF's learning objects to which she had obtained access for only five weeks (working from a CD supplied by Margery Hornibrook).

They are related to the curriculum we teach, with lots of opportunity to extend. The kids 'get it' in one or two sessions. All the right language is in there. It's fun. They find it fun. They enjoy the sound, the colour and the animation. It picks them up, and their level of concentration increases along with the amount of time they are willing to spend on an activity. I like the way they include different learning processes and how adaptable they are themselves. You can just work on one screen, work with a group or let the kids go ahead individually. I have several children with low engagement who have become very motivated and involved when we use the [learning] objects. I find that the visual aspect is very helpful for my integration students.

The only criticism I have is that I'd like more.

Monte Sant'Angelo Mercy College

Context

Monte Sant'Angelo Mercy College is a Catholic secondary school for girls from Years 7 to 12, located in the heart of the North Sydney business district. It has a remarkable range and variety of buildings on the site where the school commenced in 1875. The school was founded by the Sisters of Mercy. It is a large school of 1050 students, many of whom come from the north shore, although an increasing number come from the inner-west and the northern beaches – 47 feeder primary schools in all for the current Year 7 intake.

Despite the middle to high level of fees (about \$9000 annually), Catherine Alcock, the principal, described the girls as being representative of quite a substantial socioeconomic spread. Many of the students are daughters of ex-students; some families are drawn by the college's high level of academic success (about 80 per cent of students receive an offer of a tertiary place). She also suggested that 'Monte' girls had a longstanding and accurate reputation for being forthright, opinionated and willing to stand up for their beliefs. She emphasised the school's sense of mission in communicating a sense of social justice and willingness to act based on Mercy values. She described a range of activities in which the students are involved to support that view.

The school's program was described as 'very HSC-focused', but with a very wide range of extracurricular options for the girls to pursue – across the arts, sport, debating ... – a conventional list, but a long one.

In 2001 it was decided that ICT should be better integrated into the curriculum. Until that point ICT had been largely confined to courses defined for this purpose, beginning with elective studies in Year 9. Computers were available to staff but only in limited numbers and in annexes of staff rooms. ICT was not a part of mainstream teaching and there was little impetus for staff to change this situation.

The first step was to provide each teacher with a computer and to encourage computer use. (The first step may actually have been the simultaneous appointment of Diane Brook as the school's director of learning and technology, but Diane was describing this process.) Generally speaking, members of staff did not have a high level of skill and could be described as 'conservative' in their approach to this area of teaching and learning. Staff bulletins and notices were put online, as were student assessments. At the same time, the tasks of teaching various ICT functions were allocated to different faculties – for example, word processing to English, data management to Science, work with spreadsheets to Maths and multimedia to Religious Education – so that these various ICT functions would be taught in context.

Volunteers were sought to operate as a core group. The core group was provided with professional development to develop their own skills and to enable them to support other members of staff. This process has evolved to the point where 14 of the 110 members of the teaching staff are currently engaged in a graduate diploma in elearning. Catherine Alcock describes the staff now as 'very IT savvy' and that a feature of the school is the quality of the integration of ICT across the curriculum.

Both teachers and students are described as being 'comfortable' with this initiative. Students are constructing their own material (all Year 8 students work on the production of digital video), new software is consistently being investigated, and 60–70 per cent of teachers are using ICT in their teaching as a matter of course, with the background expectation that everyone will use them eventually. Diane noted that teachers have to 'let go a bit to do that', and also that one of the issues that they constantly battle is the 50-minute lesson period.

Moodle is being developed as the school's learning management system. This is accessible from the students' home computers. TLF's learning objects are loaded there, along with a wide range of tools and other learning resources for teachers. The school has about 300 computers, a mix of Apple and PC, with wireless Internet coverage. There are several labs and several sets of laptops. The school has just bought its first electronic whiteboard, and is testing a range of options for future hardware expansion. The system and other equipment is supported in the school by a network manager and a full-time help-desk employee and another person who works on audiovisual equipment as well as ICT.

Observed activity

We observed a Year 9 Human Society and its Environment (HSIE) class, with 22 students in attendance, in one of the school's computer labs. We had a chance to review the digital resources available for the teaching of the topic 'Between the wars' and they were expansive.

Using 'The Great Depression', the task set was to assemble a set of eight photos from the range offered by the learning object in an order chosen by the students to provide some narrative or other meaningful sequence. Students were also required to add a text caption to each of the photos.

The lesson began with a brief review of what they had done to this point – the purpose of the inquiry, the timeline of major events, and the generative causes of those events. The task was explained in terms of the preparation of a storyboard. Options were provided for the 'voice' to be present in the captions: a first-person narrative, a second-person reflection or narrative, or a third-person commentary.

The students opened the learning object at the right point easily and most were on-task quite quickly. This laboratory has two sections divided by a glass wall; and a second group of students who had arrived later were mostly in the second section of the lab. This second group was a little slower to get down to work.

The girls remained highly engaged. Some felt that the introductory character (an 'old man' with a very pronounced Australian drawl) was an oddity, but the task was clear and obviously interested them. As the photos were found suitable to the task, a range of different combinations was chosen. In the subsequent discussion, several students indicated that they would have liked more space for their captions, and some found the photos too small. They printed out their work and handed it in to Ms Brook for comment and assessment. In spite of a minor calamity occurring for one student who lost all her work just as she had almost finished it, it was a most effective lesson.

During a short discussion at the end of the class, one student noted that she liked this style of learning. 'It's visual, and you can play around with it. It's your choice.' There seemed to be general agreement with these views. 'So much more interesting than a

textbook', although some of the students said they felt they you needed both (digital resources and a textbook). They appeared to be valuing the level of detail available in a textbook.

Our informants

As mentioned above, Diane Brook holds the position of director of learning and technology at the school. Like most of our other informants she is a very experienced teacher and, as it happens, a former student of the school. She taught in government schools for a number of years prior to taking up her current position. She is an English and History teacher who had not been particularly interested in computers until taking a 'relief' class of boys who were using computers, in the late 1980s. She remembers being struck by how absorbed these students, not normally absorbed by their school work, were. She thought then that ICT must have some significant potential for aiding teaching and learning processes. She undertook a graduate diploma to develop this interest and, after some time, became that school's computer coordinator. This led in turn to her working as a consultant in the government system and pursuing her studies further. She stresses that her interest is not in ICT for its own sake, but as media for teaching and learning.

She encountered TLF's learning objects via the Catholic Education Office's Advisory Group. Currently she is an active member of a group of teachers from independent schools who are in similar situations to hers and who exchange ideas and information. She finds this a very focused and rewarding avenue for her continuing professional development.

The positive qualities of the learning objects she notes are the high level of engagement they engender in students – mostly.

We find that a good number of the [learning] objects are not sufficiently challenging for our students. They are too linear and don't offer enough complexity. The students like a very high level of interactivity.

She also notes that the absence of a Save function is a problem for use in her setting and again commented on the time issue. Nonetheless:

... they provide an opportunity to 'brighten up' teaching and learning, and they are very low-risk from a teacher's point of view. Once you've got them going they are self-contained and present little further technical difficulty. That is most important from a practical perspective.

They are part of learning through ICT, which is highly relevant in the world our girls live in. They are very active users of the web and sms and msn. What research suggests is that our students are increasingly going to be operating in non-linear modes, multitasking and ... pursuing multiple sources of information.

New Town High School

Context

New Town High School, a secondary school for boys in Years 7 to 10, is located in the inner-northern suburbs of Hobart. The school evolved from a technical school established many years ago and has been on its present site in its heritage-listed building for more than 50 years. It has an enrolment of about 825 and a waiting list. Most of the students come from the local area but more than one-quarter come from further away, including some who live in country areas and board locally. They come to New Town for various reasons. Ian Morgan, the principal, suggested that reasons include the tradition of father following son; an increasingly widespread idea that single-sex schooling is an appropriate way of catering for the education of adolescent boys; the school's success in wide variety of activities – including academic, sports, the arts, debating – helping it to be perceived as possessing strong balance in its curriculum; and, finally, a perception that the school currently had momentum for success. 'This is a gentle school,' he noted, 'but not soft, and not quiet'.

The school's students come from a wide range of socioeconomic backgrounds. Ian described the school population as largely middle-class and, like most Tasmanian schools predominantly Anglo-Celtic. However, he also noted, the fact that 30 per cent of students receive government assistance suggests a broad range of economic backgrounds.

The school has been a lighthouse school for the first phase of the Australian Government's boys' education initiative, and has put a lot of effort into literacy with some very satisfying results: Results at Years 7 and 9 are now better than the state average, and above the average for both boys *and* girls in like socioeconomic contexts. These results are the product of a major professional development exercise for staff.

ICT figures in the school's curriculum at Year 7 as a dedicated skills-based subject, to ensure that the skills of students who have had limited experience of computers are brought up to scratch. In Years 9 and 10, Computing is an optional subject, along with Computer-assisted Design. Computers are also used substantially in Visual Arts and Graphics, Music, Science and Maths.

The school has four designated computer labs with about 30 machines in each. These labs are open before and after school, when they are used very actively by students. There are 20 machines in the library, which are also heavily used; ten in the Music department rooms; and some small number in other classrooms. A major building project is occurring at the school at present with a range of new purpose-built facilities for, among other things, Arts, Music and Drama. This new building is being thoroughly networked and will provide a range of high quality ICT facilities. Two class sets of laptops with wireless Internet connection are also being purchased to provide a higher degree of flexibility and accessibility to hardware. All the staff (about 60 full-time equivalent) were recently provided with laptops. About 90 per cent of students have computers at home, and 80 per cent have Internet connection.

Observed activity

We watched a Year 9 Maths class of 14 boys in one of the school's computer labs (which had 37 computers). The broad topic was 'Space' in the sense of location and mapping. Related lessons had covered geometry and tessellations.

This class, which was the lowest stream for Year 9 Maths, were to use 'Journey planner', a learning object that has three levels of difficulty in three different configurations of basically the same activity. Provided with a map, an outline of the desired journey and a number of transport schedules to investigate, students have to work out the quickest way to make the journey. (Easier versions of the learning object provide one-step processes but this version is made complex by having multiple-step processes, and mixing the means of transport so that the user has to consult a range of schedules.) Choices are recorded on screen and feedback is provided to the user. The challenge for this group was to make sense of this process and complete the three increasingly difficult tasks in the three configurations – nine tasks in all.

The students came in as Year 9 boys do, somewhat sporadically, set themselves up at a computer, logged in and got themselves ready very quickly. Most, but not all, were experienced computer users. A number of them were also undertaking an elective involving the production of multimedia presentations, but others were clearly neither expert nor consistent ICT users.

The nature of the task and its relevance to other work was explained briefly, and most found the three-step path into the learning objects readily. For those who didn't, it appeared that the problem lay with their lack of concentration, rather than lack of their capability – which then influenced the effort they put into work on the learning objects and the speed with which they learnt and mastered the moves. Four or five of the students took some time to settle, but not very long. As John Rockcliffe, the teacher, pointed out later (see below) if these students had not been involved in activity of this nature, they might not have settled at all.

Shortly after the commencement of the class all students were fully engaged in working on the tasks. There were several moves that had to be mastered prior to developing a general strategy. John provided some broad advice; in other cases the students helped each other in this regard. Most students completed the whole range of tasks, recording their results on a sheet provided for the purpose. 'That was easy when I found out what to do,' said one. Members of one of the groups said that they enjoyed working with learning objects. 'It's better. There's more to get into. It's a bit like a game.' When they were asked if they thought that it would help them work out transport tables more generally, they weren't sure but they thought so. 'We'd have to be doing it to see,' one commented.

Our informants

John Rockcliffe is a Science and Maths teacher who has been teaching for nearly thirty years and who has a longstanding personal and professional interest in ICT (since the first Apple machines). He first encountered a TLF learning object at an external professional development activity for Science teachers last year. He thought at the time that the learning objects showed considerable potential for use, and he decided to pursue their use. He asked to be involved in the piloting of their use and so became very familiar with them. Involvement in the piloting also provided another unexpected benefit in that he was able to download the learning objects more easily than is normally

the case. (It appears that in the Tasmanian government system, learning objects can be accessed quite easily through the Department's site – Teacher Resource E-Centre – but are considerably more difficult to download for classroom use. This was an issue that arose in an earlier case study this year.)

John has become an enthusiastic user who strongly recommends the use and effectiveness of learning objects, especially with students at the lower end of the ability range. After the class, he suggested that the attention span of this group of students, if they were working with paper and pen activities for Maths, would be about ten minutes.

You can see how they were fully engaged for the whole session. Normally they turn off very quickly if they try something and don't get it immediately, but when they are using the [learning] objects they stick with it and stay engaged. It's very important to have something like this for motivation because success feeds on itself, and if they can achieve something somewhere, the chances of them being interested next time are much higher. This is what I've found in using the [learning] objects. Some of the normal barriers to learning are broken down straightaway.

Margaret Meijers is the school's ICT coordinator who, at the time of our visit, had just won a major award (along with 15 other Australian teachers) for her innovative use of ICT, which had entailed a trip to Korea.

She has also been involved in working with TLF's learning objects for some time and, given her role, has a good overview of both the products themselves and the staff's responses to them. She noted, as others had in Tasmania, the enormous demands of the introduction of the new curriculum based on Essential Learnings, and how teachers' work on that had swamped innovation efforts in other areas. This has meant that professional development is very hard to mount (and to engage teachers with) if it is not related to Essential Learnings.

She suggested that a fair amount of time is required to familiarise teachers with the learning objects, and then to plan their integration into conventional classroom processes. She suggested that about a day was required to work through processes like this. (It is worth noting that our case studies don't suggest the same for primary schools. It may be that where lesson content becomes 'heavier' and more directive of classroom activity, learning objects need to more 'exactly' match the topic and pedagogical purpose, and are therefore less subject to flexible use based on 'well, you'll get something out of it anyway'.)

Margaret described how her take-up of learning objects occurred through another teacher drawing attention to the resource and saying, 'Have you tried this? It's really good for ...' Peer encouragement and recommendation is quite evidently important. She also noted emphatically that the learning objects need to be accessible, and that continuing momentum needs to be provided for their use. While John is an enthusiastic user and Margaret has had very good mileage from 'Give me a brake!' for a unit on road safety, the school is making only limited use of the learning objects at present. ('Give me a brake!' is an object where it is possible to manipulate a series of variables – speed, mass (type of vehicle), road conditions, weather conditions, tyre conditions – to define and regulate a vehicle's stopping distance.)

However, Margaret believes that the learning objects have many positive features. She has no doubt that students are likely to find them highly motivating and that, as in the instance described above, the use of the learning object can transform a 'ho-hum data-gathering activity into an engaging unit'. She sees the strong features of the learning objects as including the extent to which they encourage visualisation of what is to be

learnt, a very effective form of scaffolding which, she felt, was particularly valuable for boys and their education.

The kids see it as a game, and play it that way out of class.

Opunake High School

Context

Opunake is a country town with a population of about 1000, located in the Taranaki district on the west coast of the north island of New Zealand. The major industry in the immediate area is dairying. The towns that dot the coastline service this industry and provide other essential infrastructure. Tourism and hospitality are other industries of some consequence in what our primary informant, Phil Hooper, described as 'a very close and friendly community'.

The high school is one of four schools in the town. The others are a government primary school, a Maori 'immersion' school and a Catholic school. The high school has 20 staff and about 300 students across Years 9 to 13, about 30 per cent of whom are Maori. On the socioeconomic scale used to describe the broad background of the student population, the school is rated '5' on a ten-point scale. There is a reasonably high level of unemployment in the area. Most of the students have to travel by bus to reach school.

The school has a strong focus on *whanau* – the building of a strong sense of family and community – and on the general wellbeing of students. All students have an individual development plan. The school uses a five-period day and a 10-day timetable cycle to support its modular system of curriculum.

The school's interest in ICT has been developed through the inclusion of ICT as a focus of faculty and school-wide action plans. Both Phil Hooper and the school's principal, Mark Bowden, commented that this has been a struggle, due to the lack of hardware and infrastructure. There are two computer rooms, each with about 20 computers, a pod in the library, three data projectors, and eight digital cameras that appear to be well used in terms of both regularity and effectiveness. We saw several inventive and interesting examples of digital material created by students and staff, which relied heavily on digital picture images. The school has a server but minimal networking. It is hoped that this situation will change in the near future with support from a private benevolent fund.

Despite the hardware and infrastructure handicaps, a range of digital learning is being employed, for example, datalogging of exothermic reactions, crocodile clips being used to demonstrate the action of an inductor and capacitor, claymation and 2-D animation, regular Microsoft PowerPoint presentations as a base for standard class lessons, and Windows Movie Maker and Adobe Macromedia being used for small-scale films. The Science, Health and Physical Education, English, Geography and Arts faculties were involved in this process. Microsoft PowerPoint presentations are regularly used at school assemblies. Most staff use the school's data projectors. This process is supported through the Taranaki cluster of six small schools ('Taranet'), which employs a private consultant to provide professional development and technical support. Use of TLF's learning objects has not been extensive to this point.

Observed activity

We observed a Year 11 General Science class with 12 students present, all but one of whom were girls. The broad topic was 'Acceleration' within a context of speeding car drivers. The session provided a good illustration of how to embed a learning object within a multifaceted set of learning experiences.

The lesson was set out as a Microsoft PowerPoint presentation projected on a whiteboard. It began with a discussion, followed by students listing the most common causes of car crashes. Students then graphed their responses on the board. Speeding and drinking were found to be the most common causes of crashes. The class then watched the New Zealand traffic authority's anti-speeding video, *If you are prepared to speed be prepared to kill*, which had been embedded into a Microsoft PowerPoint presentation that also included statistics related to damage inflicted according to various car speeds. This was followed by a discussion of the 'costs' of car accidents to the various parties involved – the driver, the passengers and other persons connected to the event. The students prepared and shared responses to that.

The learning object used was 'Where does speeding get you?'. Phil demonstrated this to the class and asked students for their advice and suggestions. 'Ah cool. I want to do that', said one student.

Phil explained the formula $SAV=d/t$ (Average speed equals distance divided by time), which is the essence of the learning contained in the object. The object contains a range of options for travel from one point to another, by varying the distance and the speed of the vehicle. The students were going to work through this process, inserting values into the formula. We didn't get any further than that because the class finished at that point. Interest and engagement levels were very high throughout the class

Our informants

Phil Hooper is head of the Science department at Opunake. After completing a fitting and turning apprenticeship and a diploma in engineering, he trained to become a teacher and has been engaged in teaching for 16 years.

He has been interested in ICT for quite some time. He describes himself as 'liking to play with information technology'. He has been using a home computer for seven years. His own interest had alerted him to the opportunities he felt ICT provided for making lessons more interesting, and especially for demonstrating concepts and modelling phenomena without having to buy specialist equipment, when explanation with just chalk and talk is not very effective. He noted the value of having material specifically tailored to the requirements of the New Zealand curriculum.

Phil has done no formal study of ICT in education but 'ideas and good website animations are shared at Physics cluster meetings'. The Taranet arrangement has also provided good learning support. He encountered TLF learning objects through his sister who is the New Zealand contact liaison officer for TLF.

He believes that more school trials are needed, and suggests that trials be conducted by teachers in a cluster of schools, as a way of increasing the range of activity and options through sharing.

For example, I could demonstrate the motion unit. We could discuss the pedagogy [on which it is based] at a grass-roots level and get some initial teacher feedback. Then teachers could go away and use it, returning to the cluster meeting for feedback.

The good learning objects are fun, interactive, captivating and result in better learning of concepts that are hard to explain or demonstrate, or difficult to get data for. The best ones also include immediate feedback to the kids. They love the competitive element of quizzes.

He suggested that a list compiled by his sister, in her TLF role, encapsulated most of his thinking about the best qualities to be found in learning objects. They include:

- creating authentic contexts for learning
- promoting self-managed and self-paced learning, with the capacity to revisit content and learning experiences
- capturing and sustaining student attention
- providing multiple pathways for learning, particularly when supported by other learning experiences.

Phil was strong on this last point.

You don't turn them into games or 'filler toys'. You need proper introductions and contextualisation, follow-up questioning and other forms of reinforcement.

He was insistent that the best learning objects make significant cognitive demands on students and that:

you shouldn't be able to advance as a result of a keystroke. Embedding quizzes or cloze exercises that require the right response is one way round that issue.

Southern Cross Campus (Middle School)

Context

Southern Cross Campus is located in the suburb of Mangere in the Manakau area of Auckland, some distance south of the central business district. The area has a very high Pacific Island and Maori population.

There are about 1900 students enrolled on the campus, almost all of whom are either Maori or Polynesian Islanders. Students are mostly from large families of low socioeconomic backgrounds. Parents are mostly very supportive. 'Parents generally desperately want their children to succeed and are heartbroken when something affects this', Ann Adams suggested. About 20 per cent have access to computers at home and about 10 per cent live in homes connected to the Internet.

The campus has four schools on the site – a junior school (for Years 1–6), a middle school (Years 7–9) and a senior school (Years 10–13). There is also an 'immersion' school (for Years 1–13) that has a strong focus on Maori culture and ways of learning and where Maori is the main language of instruction. There is a waiting list for this school. On the same expansive site are a community centre and swimming pool. The students at all schools of the campus wear the same uniform. Although there is one overall administration for the campus, each 'school' has substantial autonomy.

The structure of the school is a response to wide-ranging problems experienced a decade ago. Previous schools were amalgamated on the one site and the current structure adopted. The current middle school dates from the building program undertaken at that time. Since that time the school has been well supported by government and other agencies that are keen to make it a success. As well, some of the school's programs are privately supported.

There are about 500 students in the middle school. Literacy and numeracy are pressing issues. The students' program has 'all the usual subject areas' but, because of the need for literacy support, an extra three periods a week are devoted to this purpose. Technology is timetabled for every class group for two periods a week for two of the four terms. The ICT teacher, Ann Adams, works alongside other subject teachers and devises support programs using ICT as a tool for this purpose.

There is one computer lab with about 30 computers and another room with seven computers. Students have access to the lab during lunchtime and breaks. Each classroom has one computer, which it was suggested was mainly used by teachers for administration and word processing. Permanent staff are provided with laptops. There is one electronic whiteboard in the middle school. TLF's learning objects have been imported from a CD to the school's server. Initially an attempt was made to use BELTS but Ann Adams suggested, 'We never got it to work in a situation where ease of access is very important.' She also noted that she is the primary user of the learning objects in the school. 'A couple of other members of staff use them from time to time.'

Observed activity

We watched a Year 8 class of 26 students in the computer lab. The computers were arranged in rows facing the front of the room except for one row that faced a side wall.

One of the computers, operated by a student, was working through a data projector to a screen (which was a whiteboard) at the front of the class. Ann noted that this was a helpful pedagogical technique that encouraged student involvement in the whole-class aspects of lessons. She changes the student operator regularly.

The topic of the lesson was the area of triangles. It began with a vigorous recapitulation of some of the main elements of the topic. The students stood and with their arms practised showing 'vertical', 'horizontal' and 'diagonal'. They were reminded that a right angle was like a corner of a table, a book, a page or a photo. Students stood up together at various points of the lesson to discuss key points and the strategies they were using to solve their tasks, and also presumably to encourage concentration and focus.

Ann went through the first task with the class as a whole, using the student working with the data projector to project images to the (whiteboard) screen, and emphasising a number of points by drawing on the whiteboard with a whiteboard marker to show, for example, where the right angle was. Drawing over a projection is not something we have seen done elsewhere and it was most effective.

Then the students got to work on their own computers, using 'Area of triangles'. A triangle, initially right-angled, appeared on the screen. The task was to match the shape of this triangle, to make an estimate of its area using the grid behind the triangle on the screen, then create a matching triangle to reinforce the notion of 'area = length by width divided by two'. Finally the area of the original triangle was to be calculated. Immediate feedback was provided when students entered their results. The examples become progressively more complex, moving past right-angled triangles to oblique and finally obtuse ('squishy' was the technical term employed) triangles. This required more complex arrangements of the matching triangle. With some sporadic helping of each other, 25 minutes of more or less silent involvement followed, occasionally punctuated by a quiet 'yes!' when the screen said 'That's correct. Well done!'

When most of the students had worked through the simple examples, a more complex example was worked through, using the data projector, but with a focus on students having to work out what to do themselves by applying the rules and procedures that they had evolved. It might be a tribute to the quality of the teaching among other things, but all the students were fully engaged for the whole period on a topic not usually guaranteed to hold students' interest.

The last few minutes were spent having the students complete the survey related to this current study. The comments viewed were of a very positive nature. Some referred to the game-like quality of the experience; but more of them, presumably a reflection of their most recent experience, noted the way the learning objects helped them to learn Maths.

Our informant

Ann Adams is the Middle School's ICT teacher, in her third year at the school. She was a member of the first TLF Expert Focus Group related to Numeracy/Maths.

She trained as a primary teacher and has had a long history of interest in ICT, at least partly due to her belief in the value of ICT as a learning medium. She has had a highly varied work history that has included preparing distance learning materials in digital format for an international travel college.

ICTs are a great learning tool and that is how they should be considered in educational contexts. If they don't make life better, don't use them.

She believes that much more can be done with ICT than the present New Zealand ICT syllabus suggests, and she has worked on a range of projects with her students including recent work on digital photography and processing, the products of which were much in evidence on the walls of the computer lab.

On the subject of pedagogy, Ann is insistent that:

... kids need *repeated* experience. Kids are very quick to work out what to do intuitively, but that doesn't embed the learning. Kids new to computing can make these work, but it doesn't mean they're learning anything. They are very fast intuitively. I watch carefully for what they are 'attached to' in any particular activity. For example, the focus can go from triangles and area to just completing jigsaws. I try to observe what is really going on.

The biggest issue for me is to keep using and supporting the relevant language. For example, to stop them rushing, we read instructions aloud together. I try very hard, so it's not just a game, to set up the work so that it does become a learning opportunity, and concentrate on as many ways of reinforcement as I can think up.

I encourage them to use their bodies to model the ideas, like using their arms for 'vertical' and 'horizontal' and to chop with their hands, for example, to cement the idea for a 'half'. That worked a treat. It is also important to embed the work with computers in a series of activities so that the kids can see the relationships.

Ann feels that among the good aspects of the learning objects are that they provide opportunities for hands-on manipulation, with the qualification that it takes embedding the object in a sequence to get learning.

It is not just 'plug and play', clicky clicky clicky. They must be engaged in a real inquiry.

She used 'Wishball' (focused on place value and estimation) as an example of how learning objects could help students learn more quickly.

They get very clear very quickly because of the multiple sources of information.

St Joseph's Primary School, Hectorville

Context

St Joseph's is a well-established primary school in an area of maturing population in the north-eastern suburbs of Adelaide. It has just over 700 students in four pre-school groups and 29 class groups from Reception to Year 7. The students are drawn from the predominantly middle-class families of the local area, which has a substantial proportion of people of Italian descent – often second or third generation. It also has a significant group of about 172 students for whom English is a second language – mostly new immigrants with a range of backgrounds that includes Sudanese, Chinese, Polish and Ukrainian. The ESL provision is mostly conducted in student groups withdrawn from the classroom but also involves in-class support. Students come to the school for a range of reasons that include religious affiliation, of course, but also because the school is perceived to have strong discipline and a program for students with special needs.

The school has a large staff, many of whom work part-time, that includes specialists for ESL, Physical Education/Sport, the Arts, and a teacher librarian. While many of the staff have been at this school for many years and have well-established ways of going about their work, there is also a group of recent graduates. Sue Urban, the school's IT coordinator and our primary informant, described the curriculum as 'traditional', even though some staff are using elements of South Australia's new Curriculum and Standards Framework. There is currently no obligation for schools to follow this framework.

Many of the staff are in the very early stages of working with ICT as a teaching tool. Sue thought that a significant group 'suffer screen-saver disease', and see ICT mainly as a medium for game playing rather than teaching and learning. However most staff have good basic skills, and email is used for staff bulletins and newsletters to parents (along with paper versions). Work is proceeding on preparing assessments via computer.

The school has an IT 'room' with 30 computers. Classrooms across Years R–4 have one computer per room and Years 5–7 classrooms each have two computers. An increase in this number is planned. Sue would like to have four in each classroom, but sees having at least two in every classroom and three in most classrooms, as a more likely outcome. It is not a wealthy school. All computers in the school currently are networked. The learning objects, accessible by teachers from the school's intranet, are indexed by curriculum area, topic and level.

Most students have a computer at home, often used (by them) mainly for games. In some cases they are strictly for adult use. Most students (70 to 80 percent) are confident users who have a good level of basic skills. Most don't need any help to get on with what they want to do. The computer room is accessible at lunchtimes. Users are mainly young and male. Sue recently counted 65 students in the room at lunchtime, working in pairs or looking over shoulders.

Initially BELTS was used as a medium for interest and access to the learning objects. But this process (inserting learning objects into learning sequences among other things) proved too difficult for staff. It was too time-consuming, and the products didn't always match the direction the teacher wanted to take with a lesson or a topic.

Every class group at St Joseph's is timetabled for 45 minutes each week in the computer room. These sessions are used for both skill development and content learning using Microsoft Office software as a resource and also Inspiration software. Sue noted that she finds the mind-mapping function of Inspiration useful. She co-plans these sessions with the class teachers, the main medium of the school's ICT professional development. Among Sue's other roles is that of curriculum coordinator and she focuses on questions like 'What is the intended outcome of this lesson? What are we looking for here?' She employs her own knowledge of possible resources to enrich the content chosen for study by the classroom teachers.

Observed activity

We visited St Joseph's in the first week after the holidays when there was no scheduled use of the learning objects. However, during a visit to the computer room, we found a Year 7 class using a screen dump from 'Take a deep breath'. There were 23 students in the room, all very much engrossed in the task of using this learning object to locate and identify a number of parts of the body and their contribution to the function of various physiological systems. The students' task was to fill in a worksheet, using the material on the learning object as a resource. The students were having little difficulty with this process.

Our informants

Sue Urban, the school's IT coordinator, has been teaching for more than 20 years and has had an almost equally long association with and personal interest in ICT, beginning many years ago with Commodore 64s. She took a Workers' Education Association course in BASIC programming because she wanted to understand 'how it worked'. She undertook a graduate diploma in IT, which provided her with a good theoretical base, and for many years has been active in related professional associations. In recent years (but not at present) she has worked a couple of days a week as a consultant for the Catholic Education Office in the area of education for gifted students. As ICT use was a significant part of that consultancy role, she kept in touch with new developments and resources.

She encountered TLF's learning objects through an introductory session, a trial of the Science learning objects conducted via the Catholic Education Office about two years ago, and 'was hooked'. She felt that she could see immediately how they might be used – 'a fantastic motivational tool'. While there have been some subsequent difficulties with obtaining access to all the published learning objects (licencing issues involving the Catholic Education Office in South Australia), Sue is familiar with a wide range of the learning objects.

She suggested that, by and large, students at St Joseph's are not very interested in developing their own web pages or publishing online. She described a Year 6 class in which students were working on a theme related to law and the courts. Having developed a number of Microsoft PowerPoint presentations on this topic, they preferred to visit each other's computers in the manner of musical chairs rather than share the information through publishing means.

One of her concerns is the need to go past just clicking to 'click, read, think and do'. She is concerned that students should fully engage with the cognitive element of software use and that ICT should not be simply a medium of entertainment. In that

context, she described how she would use various learning objects ('In digestion' especially), using worksheets to make sure that students were engaging with the information, and using related activities that required students to demonstrate their new understanding (for example, establishing a dining menu).

She felt that some of the Maths learning objects could be better used via an electronic whiteboard for teaching the whole class in a conventional fashion, to ensure that all students gain understanding. 'Sometimes the message doesn't come through for some of the kids.'

She likes those learning objects that are 'strong on content' and is finding the Science learning objects on body systems ('In digestion', 'Take a deep breath') particularly useful. She feels that they:

... add another perspective. It's motivation and excitement. That's [excitement] a strong word, but that's what it is. It gets them started up. They talk about the material and follow it up. Through the computer room and the library we give the kids access to all the [learning] objects we have, and the 'thirst for knowledge' type of kids – and we've got plenty of those – go looking for them.

By and large I like the way they are constructed. I'd much rather have a server full of [TLF] learning objects than the very ordinary software that is around. Apart from anything else they are Australian and, [in terms of relevant content reference] that is very important for us I think.

St Joseph's School, Wyndham

Context

Wyndham is the most northerly town in Western Australia. Its population of about 800 is located in the town itself, at the port settlement several kilometres north and in small nearby Aboriginal communities. It has a range of government and community services including a hospital, but its main activities are centred on the deep-water port that services a very wide area of the Kimberley and parts of northern Australia further to the east.

There are two schools in the town, a government school and St Joseph's, a Catholic school that has been operating for 40 years and that currently provides for students from pre-primary to Year 7. The primary school section has four classes with six teachers and four Aboriginal teaching assistants. St Joseph's has a core enrolment of 50 students who live in the community but commonly has between 20 and 50 further students who are transient. The vast majority of the school's students are Aboriginal. The core students are regular attenders and the school is well-supported by their families, many of whom have themselves attended this school.

The school's program has a very strong focus on the development of literacy and numeracy skills. All Year 3 students are currently at or above state average test scores for literacy, which, in this environment is an unusual and most impressive achievement. Claire Kelly, the school's principal since the beginning of 2004, said:

This school does have an edge. We can't see any reason why our kids shouldn't perform at the same level as any other kids anywhere. We work our kids hard – and our teachers.

One of the issues the school faces is regular turnover of staff. To combat this difficulty, new teachers are strongly supported to teach the program with which students are familiar and which, it is known from experience, has a positive impact on student performance.

We can't afford to leave any room to catch up. We have to maintain continuity. Class groups and rooms remain the same. We don't have time to muck around. We teach some Year 4 kids who don't know the alphabet let alone [are] able to read.'

Claire, and Maureen Farrell, our other informant, were insistent that their students need structure and clarity in learning. 'They don't cope particularly well with open-ended tasks.'

The school is compact, built well to suit the tropical climate, in excellent order and with a well-stocked and very accessible teaching resource room. There are no computers in the classrooms. The reason, quite explicitly, is that 'we don't want computers to become the babysitter – games for the fast finishers sort of thing'. They suggested that when sophisticated computer use for pedagogical purposes became more widespread among staff, this restriction might change, but that it remains for the time being. The staff teachers were described as having a 'comfortable' level of computer skill.

Six years ago when Maureen arrived, the school had three poor-quality computers and dial-up Internet. When funds became available the school spent some time thinking about and investigating what would suit its purposes best.

The school library/student resource room has a lab of 10 high-quality computers. Every class is timetabled in this room with Maureen for an hour a week (which is generally used as release time for the class teachers). It is also open from 6.30 every morning, to encourage early/punctual attendance among other things. There are often 15 to 20 or more students in the room before school starts at 7.30 am. In addition, each class has a lunchtime set aside for computer use. The computers are also used to some extent in small-group rotations for activities in numeracy and literacy. Other equipment includes a digital projector, a laptop, digital cameras and a digital video. 'We don't have anything the kids don't use.'

Although, for some reason, the local area has very fast broadband availability, very few of the students have computers at home. But the school program 'is absolutely based on the fact that kids come to school equipped with a range of technological skills.

Everyone has access to Game Boy or Xbox. They all use DVDs at home and are accustomed to the sorts of controls and commands that are conventional in software. Most of them have very good manipulative skills. Maureen says, 'We're not going to spend time teaching them what they already know and can do'. Prior to the advent of TLF learning objects, students had been primarily encouraged to play 'hard', conceptually challenging, games, which they took up with alacrity. Claire says, 'We don't want to teach them anything they can't apply to new situations'.

The schools' digital resources are accessible through the Myinternet management system, and those selected for use are mounted in the relevant Myclasses section.

Observed activity

We noticed that, on the day of our visit, all the students attending St Joseph's spent time working on computers.

We began with eight Years 1–2 students who easily followed the instructions to log on and to go to Myclasses. This group didn't use any of TLF learning objects during this time. Maureen explained that the main purpose of her work with these students was to develop skills in thinking laterally and strategically as well as practising their navigation skills, which were in evidence.

The Years 6–7 group went into their section of Myclasses to 'Literacy for big kids'. This included many TLF learning objects designed for literacy support. Students were reminded to start at level 1 of the learning objects they had chosen for the session. They could work individually or in pairs. Most chose to work on their own, but there was a good deal of sharing. 'Rap machine' was popular. They had previously enjoyed 'Make a movie'. They were deeply engaged and obviously enjoyed using the learning objects. Maureen mentioned that some of the values she saw in these learning objects were the clarity of the instructions, the way they captured the students' imagination and the necessity to use a wide range of skills. 'Challenge and self-pacing are very important for learning, and these learning objects seem well-pitched [for those purposes].' One of the students said that he found the learning objects 'sort of complicated at times, but when you finish, it looks good. I really like them'.

The Years 3–5 group was also able to select from the same range of learning objects. 'Underwater discovery' and 'Rap machine' were two of the learning objects chosen. By the end of their time many of them were engaged in the cloze exercises included in the learning objects. Many of them chose to read the text out loud from the screen to share with their partners. They were especially fond of the animations and the jokes and

surprises that appear from time to time. ‘Ah deadly. Here she comes again. That one there. Look! I love this one.’

There was unanimous agreement when this group was asked if they liked working with the learning objects. Reasons given included: ‘interesting, fun, not always the same’; ‘they’re cool and help us learn’; ‘not too hard, not too easy’. They also liked the sound elements of the learning objects. ‘If you can hear it, you can learn how to say the word.’ Several of these students indicated that they had learnt new words as a result of their recent experience and were able to cite examples.

Our informants

Maureen Farrell is in charge of ICT at the school. She is nominally part-time but spends a good deal more than her scheduled two days a week there. She finished her teacher training more than 20 years ago and then for a decade worked as a Ministerial assistant and adviser. She moved from Melbourne to Perth to perform some tasks for a union, went north and stayed. Initially she worked at the Aboriginal Corporation’s women’s safe house in Wyndham, but has been at St Joseph’s now for five years.

She has ‘always’ been interested in computers (‘information services’, she recalls, was the term used in her early experience).

Everything we do with computers is based on learning outcomes. We don’t use computers for the sake of it. We use them as another tool to assist student learning. ‘Best practice’ pedagogy is at the forefront of everything we do. I am not a tech head, but I can build a computer or set up a network. One of the issues round here is that schools don’t have someone like me. You can import all the hardware you like but you must have someone to look after it. If we hadn’t bought computers of the quality we have here, I’d be spending half my time fixing them. I can ensure everything is working, which cuts out that machine failure element, which in teaching you simply can’t afford.

It was media that brought me up here. I was working on a project about rural workers – promoting their expertise and self-confidence and looking at options for adult training.

At the safe house Maureen found that collecting data by digital means was an invaluable way of assessing what was happening there, for example, for recording information about which children were spending time there.

Maureen is very positive about TLF’s learning objects.

Until they arrived we had a lot of point-and-click software and games. This is a big step up. One of the strongest recommendations is that when kids can do what they want on the computers they often choose the [TLF] learning objects.

I’ve been through what seems like thousands of pieces of educational software, and these [TLF learning objects] are almost perfect for us. The [Years] 3/4/5 class has worked with ‘Wishball’ [to develop an understanding of place value] for a term. They loved it; went straight to it. It is an excellent diagnostic tool. You can tell just where they are up to in their understanding. But it also has clearly helped the kids. The different expressions of number (for example, abacus, graphic chart) are very useful for reinforcement. You get 20 turns so there is a bit of a gaming process going on that they love. It’s a bit of excitement.

Interestingly some of the students went straight to – and have continued using – the subtraction option. The [learning] objects have also been useful

for the teaching of Chance and data. They all love 'Rap machine'. The better ones for our kids are less text-heavy and have text that kids can easily use. Boys and girls like them equally.